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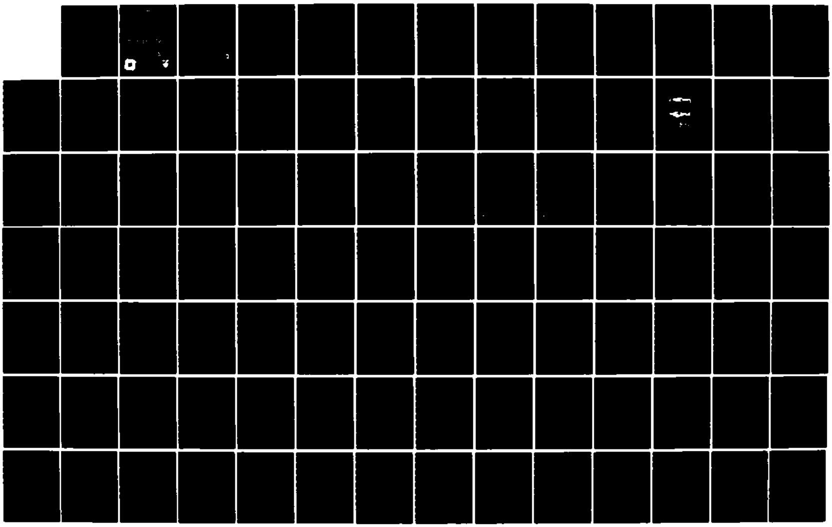

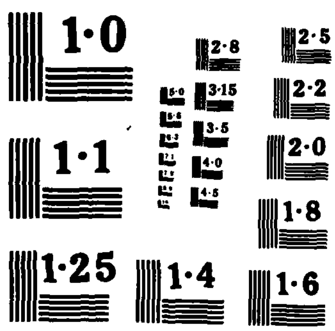
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VOLUME II

PROCEEDINGS

NOV. 30 - DEC. 2, 1981

3rd INTERSERVICE/INDUSTRY TRAINING EQUIPMENT CONFERENCE AND EXHIBITION

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

PROCEEDINGS OF THE
THIRD INTERSERVICE/INDUSTRY
TRAINING EQUIPMENT CONFERENCE AND EXHIBITION

CONFERENCE CO-CHAIRMEN:

Colonel Donald M. Campbell, USA
Project Manager for Training Devices (PM TRADE)
Orlando, Florida

and

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Vice President and General Manager,
Systems Management Unit of the Sperry Division,
Sperry Corporation

Sheraton-Twin Towers
Orlando, Florida

November 30 - December 2, 1981

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December 1, 1981

NOVEMBER 30, 1981

SESSION I

OVERVIEW

Mr. Kurt Merl

Good morning. I'm Kurt Merl, Conference Chairman, and it is my pleasure to welcome you all to our third Interservice/Industry Training Equipment Conference and Exhibition.

As you know, one of the Carlucci initiatives of the current Administration has been to establish positive relationships between government and industry. I think we can be proud that this conference over the years - now in its third year - has always been based upon an open and bilateral exchange of information between industry and government to achieve the best we could in terms of producing training equipment and better products for the services.

With the current turmoil that we all see in the development of the Federal budget, it seems to me that greater attention has to be paid by all of us in terms of attaining a more cost effective training product for our taxpayers' dollars - more innovation with our technology and better productivity in the task of training the people that we all support.

So it is one of the main objectives of this conference to help in making all of that happen. As you know, the participation of people like General Otis, Norm Augustine, Congressman Gingrich all attests to the importance of what we're trying to get done here.

We've placed special emphasis on this particular conference this year in giving the user organizations the opportunity of giving us their views on the training needs of the individual services. I plan to listen to them and I know you will, too, because I suspect that they are going to be very clear in their messages. If the Executive Conference that we had yesterday afternoon is any example of that, I suspect we're going to hear some very interesting things from the rest of this conference. The business that we are in is one where if we don't listen to the users' views, we're quite apt to produce technical marvels that no one can use.

The technical sessions that we're going to hear tomorrow are going to explore many of the technologies which you and I know will in the future have a very significant impact on the training devices and training programs that we're so heavily engaged in. As you know, those are going to be parallel sessions. They're

going to be distributed in various rooms. The speakers have all promised to stay within their allotted time and their allotted schedules, so I suggest you schedule your time, budget it wisely, and I think you'll enjoy and learn quite a number of interesting things.

One of the most exciting aspects of this year's program will be the User and Management Panel sessions, where I'm sure we're going to hear some very lively discussions. These panels will offer all of us the opportunity to actively participate during the question and answer session. It's very rare that you have the opportunity to get a group like the one we have scheduled for each one of these panel sessions, and I suggest that you make adequate use of that opportunity to fire away with the questions that you consider the important ones from your point of view.

As far as the exhibits are concerned, I think they're the best I've seen to date and they'll speak for themselves. A lot of effort has gone into their preparation for the last three days and I'm sure you'll find time to visit them during the next three days.

We, the Committee who have worked very hard to make something out of this, sincerely hope that this conference will provide for you, the attendees, an atmosphere and an opportunity to discuss the issues that you consider the important ones, both among yourselves and with the speakers, and also an opportunity to enhance business relationships for those of us in the industry, and help the Defense Preparedness. In the final analysis, a conference like this is what you make of it.

So enjoy, learn, communicate, improve.

I'd like at this time to introduce to you a gentleman who has been a General for 35 years, former head of the Army Material Command, is currently the President of the American Defense Preparedness Association. General Henry A. Miley, Jr.

General Henry Miley

Good morning ladies and gentlemen, and welcome to our third conference, and let me add my welcome to those of Kurt, who identified me as a person who has been a General for 35 years. Not quite.

The Association is delighted to sponsor this third Conference and Exhibition, and Captain Nelson Jackson, our man in Orlando, tells me it is the largest of the three. That seems to testify to the growing sustained interest of the Services in simulation devices and training devices. I think this interest will continue,

both spiritually and financially, as the cost of operating and shooting our sophisticated equipment continues to go through the roof. I think the growth will continue even though the euphoria we felt six months ago with the Reagan defense budgets and the prospects of larger budgets in the future, has dwindled somewhat in the last few weeks.

The Army is the Executive Agent for this meeting and Colonel Don Campbell will follow me at the microphone and is the architect of this meeting for the Army. We've had great support from the Navy Training Equipment Center and we owe a collective salute to its commander, Captain Jack McHugh.

I'm not going to extend my remarks, except to offer one personal observation that may help you in the next two days and it goes like this. As I closed out my career in 1975 as the Commander of AMC, and I had spent a lot of time traveling around the world, visiting the user and looking at his equipment which we were charged with designing, developing, procuring, and supporting, it seemed to me - and this observation was shared by others - that even though our Army troops in the field operated their equipment reasonably well - they shot it well and moved it well - they continued to have growing difficulty with maintaining it. This was particularly true of equipment that involved black boxes. I was always horrified when I came back from a trip and reported to my staff that wherever I went, I encountered piles of unserviceable equipment that seemed to be beyond the capability of the using troops to maintain. In fact, the black box people invented the term "anomaly" when I kept using the word "failure."

In any event, it seems to me that the simulation training device industry might occupy some of its ingenuity in trying to help the Army - and I'm sure, the Navy and Air Force have the same experience - in devices and simulators that will assist in the training of people to fix things. I think unless we solve this problem, we're going to have trouble as we field the more sophisticated equipment of the next decade.

Now, as a footnote to this, if you field simulation devices and training devices that involve sophisticated black boxes, unless you provide a contractor support team right with that device in the field, you've merely added to the troops' problems with fixing those black box devices. So you can crank that away in your computer and maybe something will come of it in the future.

I'm glad to be here and look forward to participating with you in your exciting 2-1/2 day conference. Thank you.

Colonel Donald M. Campbell

Thank you, General Miley.

I'd like to extend a personal welcome to all of you and I hope that you enjoy your stay in Orlando. I didn't realize when I stood in front of you at the closing luncheon last year in Salt Lake City a few of the things that really go into making up one of these conferences. I didn't realize how fast the year would go, from 20 November 1980 to 29 November 1981. It's been a really fast year, not only from the job standpoint but from putting the conference together. You never think you're going to be pushed and then suddenly, it's the last day, the last minute, and everything's with you.

Secondly, I didn't realize, as a new Project Manager, what there was in the simulation and training device business. I still don't know a lot of it, but it's been packed in and shot at me and really pumped in this whole year, and I appreciate the help of all of you out there for bearing with us this year and helping us down the road.

Thirdly, I didn't realize what an ambitious task we had undertaken in trying to get the real users and the real trainers of the Services down here with us. We've been very fortunate in getting the folks who really make it happen in the simulation business to join us this year, from the Assistant Secretary of the Army for Research and Development, Dr. Sculley, who is down here with us, General Otis, and all the rest. We are really fortunate and I hope that you'll partake of the sessions, whichever ones are of your want, and really get into the discussions because they're here to discuss and go back and forth with you on the things that are important in our business.

You've heard enough from me, and as I said, we're really fortunate to have with us today the head Trainer in the United States Army, the Commanding General of the Training and Doctrine Command at Fort Monroe, Virginia. As a trainer and user, General Otis has no peer, I feel, in the United States Army because he has been in this business from the squad level through the division level, in combat in two conflicts, and really knows what it is to train and use training devices and techniques. He has also been in the Training Development business as the Deputy Commandant at Fort Knox, Kentucky, the Home of the Armor, and had the Command Arms Combat Developments Activity at Fort Leavenworth, Kansas. More recently, as the G-3, Deputy Chief of Staff for Operations and Plans of the whole United States Army, at the Department of Army in the Pentagon. Today, he is the Training and Doctrine Command Commander at Fort Monroe, Virginia. About six months ago at the Army Ball, sponsored by PM Training in Orlando, I was able to introduce General Otis as a

three star officer of the Army. Today I'm even more honored and pleased to be able to introduce him as the four star Commander of the Training and Doctrine Command. Ladies and gentlemen, General Otis.

General Glenn K. Otis

Thank you, Colonel Campbell. General Miley, Dr. Sculley, Mr. Merl, ladies and gentlemen, colleagues, fellow workers, it's a great pleasure to be here and exchange some thoughts with you. As a matter of fact, I stand in awe of an audience like this because your jobs and the jobs that some of us hold require such a close and intimate link, and yet so many of us in uniform fail to understand where you come from. I think it's on that leg that I open the talk this morning. One, to share with you some thoughts, and two, perhaps to extend to you an appreciation for what the Army looks like and where it seems to be going, and finally to give you some insights as to perhaps where you can best apply the leverage that only you are charged with doing.

I think that the idea of a conference like this is great. I share General Miley's points. But I must tell you that when the leader of the conference, the organizer, Colonel Don Campbell, has to put all those embellishments on the introductions, it sort of says that he's trying to apologize for the quality of the speaker. So please bear with me - and if you lose your job, Don, you'll know why.

Actually, the message this morning is very simple. If Penn State can do it to the number one team in the country, why not! Jack, is there any relationship between having this conference at Orlando and the fact that Disneyworld is here?

My message, though, is serious. First, let me congratulate the American Defense Preparedness Association for having this initiative the third year in a row. Certainly I congratulate industry - all of you, because you've taken the time and the effort and the expense to come here. And I'm equally impressed with just the first walk-through of the displays out there, which again shows your interest and application.

So I thank you, General Miley, and the Association, for this initiative and the opportunity to stand and talk for a bit. I said the message is simple. It really involves three points. First of all, I believe the need for what we are about here at this conference, the need is great. Secondly, there is a tremendous opportunity for movement in training devices, training simulators, and the overall field of training aids. And finally, and maybe this isn't the optimistic note of the first two, I think the criteria are tough and they're going to get tougher. Perhaps before my remarks are over, I'll lay out some of those tough hurdles.

You are going to have user needs discussed at length this morning and a panel that discusses how to meet those user needs. So I'll use these few moments to do what the agenda calls for - to give you an overview and a backdrop against what you might consider some of the later remarks.

First of all, and I'll speak only for the Army because I know that best - but you'll hear something about the other Services, as well - in our Army, starting now and I believe for the next ten years, we are undergoing a major reorganization. The reorganization that I'm talking about starts with a basic change in doctrine. Let me tell you how important that is. Our doctrine has been, in the past, overall nationally, a strategic defense. There's no change in that. Today we still are a nation that believes in strategic defense. But inside that overlay, the Army doctrine, the operational level and the tactical level, is one of offense. That's not a subtle change; it's a very real change. You'll find that driving our thoughts, focusing our field manuals and our doctrinal publications will be that theme that says, first of all, we want to deter war and the best way to do that is to indicate, should war come, we're there to win not to avoid defeat. Now, that's a philosophical difference, but it's a real one. Internal to that, our doctrine says, at the operational and tactical levels, we'll attack and if we are going to attack, and if the enemy we face is a mobile, highly sophisticated enemy, then we'd better know how to do that with better mobility and more sophisticated equipment and better leaders. And so our training is oriented on exactly that kind of doctrine. It says while we go on the strategic defense, operationally and tactically, we're offensively oriented.

A lot of our training devices and simulation has not taken that view in the past. As a matter of fact, we've looked more at the passive defensive type mechanisms. Turn those wheels and put that thinking cap on because in this total reorganization, the doctrine is part of the driver.

Now, if our doctrine is as I've just outlined, that is, one that orients itself on offense rather than defense, allied to that is a total organizational reorganization of the Army. Let me bring that into focus for a minute. Starting at the very lowest levels, the squad, and working right up through division and even corps, Army organizations have now begun a change. Writing that down on a piece of paper or listening to someone describe it is a fairly simple process. But when you apply that across the total force, and by the way, I'm talking about a 1-1/2 million person force. The active army is about 780,000, but when you add the reserve components and the civilian force, all of which are involved in the total reorganization, we're talking about a million and a half people that will be affected. And so, it's very significant and it starts at the grass roots level. Our basic cells - armor, infantry, artillery - are changing today. As a matter of fact, with the introduction of

the M-1 tank starting now in Europe, then Europe begins its reorganizational phase. Even organizations that are not maneuver-oriented but support oriented are changing their nature and face.

The reorganization involves all the fibers. General Miley mentioned a real challenge - maintenance. I'll talk to that more later. But in this context of reorganization, even some of our basic principles of how to maintain equipment and at what organizational levels are being changed. So it's a time, then, in this decade, of total Army reorganization.

If you complicate and make turbulent the situation of total reorganization, of a new doctrine, a different outlook, a change in philosophy, and then add to it literally hundreds of items of new equipment to be assimilated into the force at the same time, then I think you'll become aware of this decade of change that we have now started. Some examples --

In the past, the Army has undergone several organizations and a lot of new equipment changes. We've done that sometimes smoothly and sometimes not so well. But at no time that I know of in our history have we made such dramatic and such widespread changes. In the combat electronic warfare and intelligence field, we are at the same time creating new organizations and giving those new organizations new capabilities and different equipment. In the artillery - in the past, we have introduced new artillery weapons and a one-for-one exchange was done relatively smoothly and simply. Today we are introducing not just new artillery weapons on a one-for-one exchange, but we're increasing the number of weapons in each battalion. At the same time we're giving those same battalions new kinds of artillery rounds that have never before been used in combat - artillery-delivered mines, the capability to shoot improved conventional munitions by artillery that will now kill armored-type vehicles. These new and different capabilities, at the same time with additional weapons, are further complicated by adding command and control devices that affect the individual soldier out there in the forward observer post right on back through the major fire direction centers of the artillery. So it's a dramatic, complete change.

Simultaneous to this, the armor community is adopting the M-1 tank, the Abrams tank. But as that tank is fielded, we're changing the organization to take advantage of that added capability. So instead of five tanks in a tank platoon, we're going to four; yet we're going to make more companies in a tank battalion. And at the command level of a battalion, we'll now have battalions with 58 tanks, 7 more than the current battalions. And so, once again, organizational change, conceptual change, equipment alterations - all combine to produce a different kind of force.

In the infantry, mechanized infantry has for many years now gone through a series of changes of the types of carriers they've had, from the old M-75. In fact, it started with half-track, and then M-75, M-59, M-113. Each of these carriers has done little more than put infantry in the back of an armored carrier and carried him through some of the artillery and small arms to where he could then get out and fight the battle. With the introduction of the Bradley Fighting Vehicle, I have a completely different concept of infantry. First of all, he does not just ride under artillery, but he is able to shoot and move from that vehicle. The Bradley Infantry Fighting Vehicle has a stabilized turret with a large caliber gun that can shoot and kill armored vehicles at over a mile's range. It requires sophisticated fire control, different kinds of training, on those infantry soldiers. And so, as we incorporate the Bradley Fighting Vehicle into that force and marry it up with the Abrams tank in the armored force, and the additional capability of the artillery battalions, and we put that all together in the framework of a new offensive-oriented doctrine, the state of change is clearly great.

Now, I've woven that together for you in this way because I believe that that's where the opportunity lies. As a matter of fact, I'd suggest you look carefully at what that opportunity means - I know we are, internal to the Army - and see if that opportunity is being answered by the right outlook today, the correct one. Example -- if we have done our work correctly, if we've done it properly and right, the new tank ought to be able to be used by soldiers with even less training than in the past. And I believe that's exactly what's happened. A gunner today inside an M-60 tank is faced with a situation that's much simpler than what he had in the M-48, because we've put together the fire control instruments in a better way, in a more packaged way, so that the sophistication of the M-60 becomes more transparent to that user gunner. We did away with a lot of the complications of the M-48, where at one time, you had to take every individual gunner through 1,000 rangings before you could even set the interpupillary distance properly in the sights. That's gone. It's gone with the M-60. At one time, to train that M-48 gunner, you had to make sure he could see stereoscopically, and about 40 percent of the population can't see in the stereoscope mode. And so that complicated the selection and the training. We did away with that with the M-60.

Along comes the Abrams tank and there are some who would lead us to believe that because we put sophisticated stuff inside the Abrams tank, we now are unable to train the user, that gunner and loader, to be able properly to use that weapon in combat. Well, I suggest that begs a proper analysis. As a matter of fact, it's dead wrong. All of our training and tests show that to the user, the guy who has to employ that tank, the guy who has to do all the complicated stuff inside, it's a simpler problem to train him. And he gets results - almost instant success.

As a matter of fact, we've taken some of the disbelievers who are not in uniform, put them in the M-1, given them seven minutes worth of training, and they can hit a target a mile and a half away on the first shot.

Now, back to General Miley's point. How about the remainder of the Army in that armor community that has to support the Abrams. Instead of a hydraulic, mechanical-type fire control and turret system, endemic to the M-60, we've now changed and the Abrams is electronic in its concept. We've put a power train in there that has as its basis a turbine engine instead of a diesel. And so, the maintainers - and if you ever did the count, you'd find that the maintainers equal in number the users - the maintainers are the ones where the difficulty of training occurs. That same sequence of events is exactly what's happening with the infantry. We will find ourselves able to train infantrymen to operate the complicated equipment because we've put the right panels over the complication, we've hidden it, made it transparent to the user but not to the trouble-shooter, the maintainer.

I think that's a real challenge for this industry. How can we best, we in our total - the industry and the military - provide the right climate, the right devices, the right simulations and all the training aids necessary to train all of the support people? Don't, I charge you, don't become overly concerned with emphasis only on that employer of the weapons system.

Let me go to the artillery again. Acquisition radars of the past - relatively simple. Not very accurate, not too reliable, but relatively simple. It still took a lot of training on both the user and the maintainer. Now the new acquisition radar -- when it works right, when it's operated correctly, and when it's maintained totally, out new acquisition radars are able to operate in almost an autonomous mode. From the inception of an incoming artillery round until our guns are able to shoot back at the spot from whence that round came can be done automatically if our total system fits together, works right, and is maintained properly. And that's the concept for the new acquisition radar.

But for all of that to work, for all of it to be done right, the training of the maintainers as well as the users and that whole supply field that keeps them rolling - the training of those people is perhaps our biggest challenge.

Well, the backdrop then that I've described, the total reorganization of the Army, has begun now. A change in concept and doctrine that drives part of that reorganization and the assimilation of new equipment, other than on just a one-for-one exchange but brand new kinds of things - things like a remotely piloted vehicle, perhaps - things like a multiple launch rocket system not in the inventory today - when we put all that together it says the opportunity is great and the need is great.

And so, those are really the front end of the challenge to you, as well as to the group in the front row.

Now, let's talk about some of the criteria that are going to govern how well we can answer the challenge and the need.

First of all, I believe that with the emphasis of the Reagan Administration on better preparedness and better defense carries with it the corollary responsibility that for every dollar that Defense allocates, there's got to be a dollar's worth of pay-off. And that means as we go from less bread and more guns, we'd better be sure that what we're doing has a real dollar leverage pay-off. There's no way that the Army does that by itself. It's got to be an Army/Industry team. Your motive in industry has got to be profit, basically. We understand that and so do you. Our motive in Defense has got to be preparedness and for those two basic motives to marry up, you and I have to be on the level with each other. That means that as you look at these challenges and try to figure out which way the corporate entity should go, be sure that in your calculations you've carefully constructed the notion of dollar leverage. I feel certain - and I'll say this from my point of view as the Commander of the Training and Doctrine Command and the surrogate representative for the user - that where the dollars get big as compared to the forecasted pay-off, then there'll be little utility for us to work together.

Next point in the challenge -- I believe we ought to look at devices, simulations, and capabilities in the training aids arena for wider application. I see very little reason for having a complicated simulation device based upon electronics, based upon manipulation hand/eye coordination, and based upon the need for training certain categories of people on a given system not to have application to more than a single weapon itself.

When you and your research and development people look at weapon systems and the need for training maintainers, I challenge you -- and I'm sure that you would agree -- that if we put that total picture together, we'll find commonalities there that offer great opportunity. It is those outfits, those companies, that can offer commonality of device across a range of training requirements that stand the best chance in the future.

Another point. In the past, the Army has not served itself well in its work with you to produce the required training devices in the timeframe of interest. Example -- we're still fighting today to get out reasonably good training devices for the Abrams tank. We've already gone through the operational test of the tank and we're fielding it today. And yet, we still don't have the training devices that are necessary to totally support it. And that same thing is happening and has happened with a whole series of our systems. The culprit stands up here. As a matter of fact, in 1974, as the leader of a tank study group, I totally failed to make sure, 7 years ago, that

we were applying the proper dollars, the proper attention, and the proper needs to the training devices for that Abrams tank. And we're paying the penalty of it right now. I assure you that I've learned from that lesson and that a major thrust from the Training and Doctrine Command will be early fielding of the necessary training devices to support the training of the systems.

Next -- in the past, we have very often looked at training devices and simulations as a separate entity. I believe that the actual equipment is a tremendous training device, and what we need to do is incorporate the necessary ancillaries on that equipment - plugs, hook-ups, other devices - to be able to use the piece of equipment itself as the trainer but not having the operator actually move it. Now, I don't know what that means in every case. You and I both know what we did with the A-2, the M-60 A-2, in that arena. That was a good device. Let me make a parenthetical expression. I'm not saying the M-60 A-2 was a good device. That's why it's no longer in the inventory. But nevertheless, the M-60 A-2 trainer was, and it locked right into the turret of the M-60 A-2 itself. We've got to do more of that.

So I would say that those criteria of dollar leverage, wide application, get it coincident with the fielding, and make it a part of the actual equipment are some of the governing things that you and I both ought to tend to for the future.

Now there are some other things that are important. I'd like to tell you where I see some very real gaps right now. Gaps, that is, between what we have, what we're going to do, and the need between those to make them fit together right.

Example -- today, as you look across the entire Army, our ability, our capacity of ranges and facilities is totally inadequate for the wide range of new systems that we are fielding. In Germany, for example, the training areas totally available to all of our force in Germany are no bigger than Fort Benning, Georgia. And that's almost five divisions of our force over there. In the United States, there are not more than two places in this entire country where we are able to take the Army's newest round of ammunition on the Army's newest tank and fire it at the maximum effective range of the tank's weapon. Now, how are we as a nation going to train totally our force and guarantee ourselves that that force is trained if our ranges are inadequate in order to be able to do it? That's what we're faced with. I think that's a challenge for the industry in several different ways. The more obvious ones are the simulators and substitutes for actual firing. We need them badly, and, of course, many of you know how much we are working toward that end. But other than that, there must be ways where we could use available ranges and still achieve the objectives we must of total force application. One of the places we've put a lot of our effort into and one that holds great promise is out at Fort rwin where we've

constructed that National Training Center. And that's just a good idea, one that was way past its time.

But it's taken a lot of effort, a lot of dollars, a lot of peoples' work. And it isn't finished yet. As a matter of fact, when we start the full-scale inauguration of it in January, when we start it, an individual battalion in the Army will get there perhaps every 18 months. And that's only with optimal scheduling. And so, totally inadequate for the total force, regardless of how much needed, there must be ideas here in this audience and in the people who work with and for you that can overcome some of that shortcoming.

Today, even in its inauguration in January, the National Training Center will still not have the instrumentation needed to take care of air-to-ground operations, air defense operations, and the totality of that force that must be put together in the right way for the Russians to believe that we know how to do it. So there's a challenge. Ranges, facilities, are very weak. We need help. The opportunity there exists.

There's another part of that. Ammunition itself. Each year we are spending billions on ammo and there will be no diminution of that. We need to spend those billions for our ammunition stocks and supplies. We spend part of those billions every year shooting it in training. Some of the same ammunition that we need to shoot in war is the stuff we fire for training as well. Sure, it's costly. But I'm not so much addressing the cost as I am the total availability, because given that we must fire certain numbers of rounds of each type of ammunition every year in order to keep our soldiers trained and to train the new ones, nevertheless, that stockpile must be built up because today it's inadequate and the other guy knows that.

So we're faced, then, with an allocation each year of so many dollars and within that, how much can we afford to put towards training? Your industries, your work, can lessen that allocation to training. There are other nations today that are ahead of us on training devices that reduce the necessity for live-round firing. There are other nations that are ahead of us - and that's a fact, not a conjecture.

Next point -- as we look to the future, you, industry, have told us, the user, that technology is changing rapidly. As a matter of fact, there have been some conjectures - and maybe it's fact - that within five to six years, technology changes almost 100 percent, especially in certain industries and the electronics industry is at the forefront of that very rapid change. Now, if that's true, why are we spending eight to twelve years in development of individual items, depending upon today's technology? I say to you that a very real question from now and for the future on any device is going to be how soon can you produce it. That's

going to be a two-way street. Because our bureaucratic systems, the Army's, the Department of Defense, have served immeasurably to that total production time, that total development and production time. So on our side - and I pledge my work in this - we've got to find out what we're doing to complicate the system. And we'll do that -- that's a promise. On your side, be advised that the challenge to you, when you come to TRADOC as the user's representative, is going to be if it takes more than six years, don't talk to me.

So the challenge is there. And the glove and gauntlet are laid down. You go to work to figure out why it takes so long to produce it, from concept to production, identify where you're the roadblock, identify where we are, and at the same time, we're going to go to work to find out how to reduce that cycle ourselves. Other countries today are developing from concept to fruition devices and real weapons in less than half the time that we are. We're going to have to answer that challenge because our industry, which is the leader of the world, has got to become the leader of the world, as well, in that total timeframe. We can't wait for 12 years for something that you're thinking about now that's going to support that multiple launch rocket system that will be here in 3 or 4 years.

The criteria, then, are: 1) how much utility do we get for the dollar; 2) how widespread is the application among a variety of systems; 3) can you get it to us in the time we need it and before the technology is already advanced to make what you're producing outmoded. I believe that those criteria and some others that I've touched on this morning are reasonable measures of success. You're going to hear, as I mentioned earlier, from the users and the user community and from a lot of people who have to work in this field - you're going to hear what the real needs are in detail. But I believe that if you will consider the backdrop against which those discussions are made, that is, a very real and fundamental reorganization of the Army at the same time of incorporating the new weapons and equipment, and if you put that against dollars and time as well as that total training transfer and application, that the guideposts are clear. From the Training and Doctrine Command, at any rate, we intend, as we have in the past, to work as closely with you as possible to achieve the needs in the training simulations and device arena. I suggest very strongly to you that as we work together, let's make sure that we all understand the dimensions and the backdrop against which we work and that time parameter that I suggested to you ought to be a good start.

General Miley, Mr. Merl, I appreciate the opportunity to have been able to address this audience and the fact that the American Defense Preparedness Association would provide the backdrop here. I hope that as this conference progresses through what appears to be a very dynamic schedule, that you will find

that the backdrop remarks were only that and that the real guts of all the issues will be discussed later. And finally I hope that the feedback that you will give in those sessions will come flooding back to the users so that we can work better as a team to produce what is a critical need for the total Army.

Thank you very much.

Mr. Merl

General Otis, I'd like to thank you very much for taking the time from your very busy schedule to prepare and give us such a stirring address. We certainly hope we can live up to the challenges that you've laid forth so clearly to us.

SESSION II - USER VIEWS

Mr. Merl

We continue now with Session II which deals with user views. There will be various presentations during the course of this session and in order to afford you the opportunity to ask questions, we've placed microphones in various areas throughout the conference hall and as each of the presenters completes his part of the presentation, there will be an opportunity for questions and answers. Please avail yourselves of the opportunity to use the microphones, ask your question so everyone can hear it, and I'm sure it will be dealt with appropriately.

When it comes to the subject of user views, we have with us a moderator for that session who is really in an excellent position to lead that kind of effort. He has seen service in every kind of infantry division - mechanized, airborne, airmobile, and infantry. He is both a Ranger and a Master Parachutist. I was impressed with his statement that he has worn the green tabs of a troop leader at every consecutive grade from 2nd Lieutenant through Major General. Since February of 1981, he has been the Director of Training, Office of the Deputy Chief of Staff for Operations and Plans, or as it is commonly known DCSOPS, in Washington, D.C. Ladies and gentlemen, Major General Guy S. Meloy.

General Guy S. Meloy, III

Mr. Chairman, General Miley, ladies and gentlemen. One of the real handicaps of being a two star following a four star is the four star doesn't ordinarily tell the two star what he is

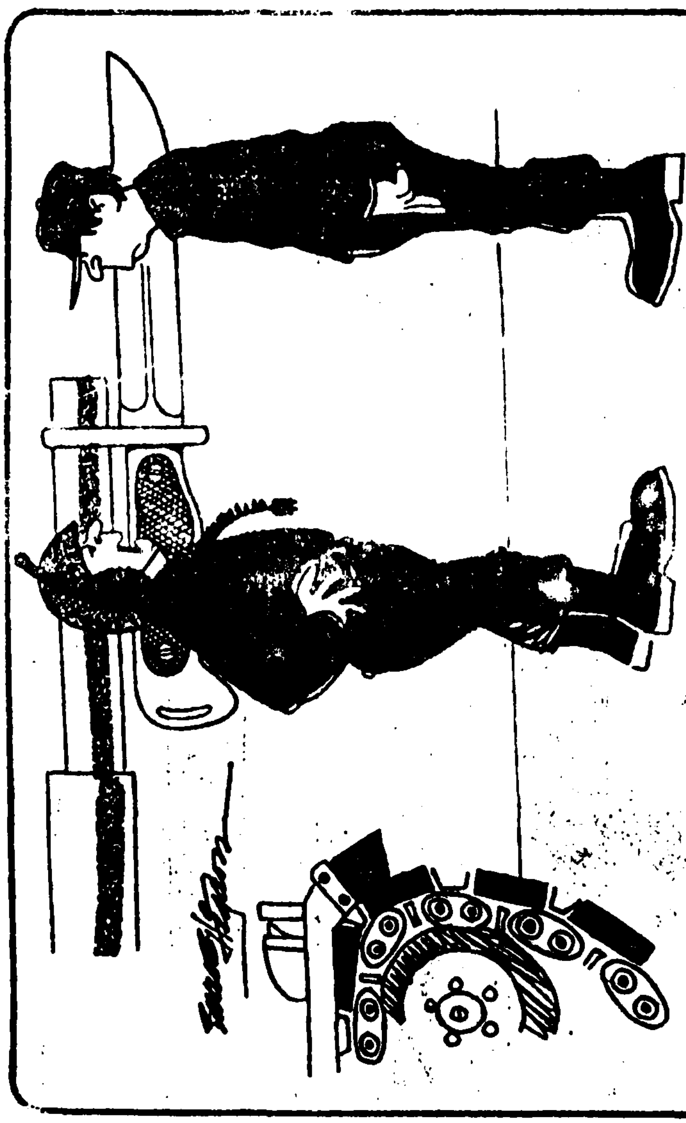
going to talk about before the fact, and General Otis has just done a magnificent job of stealing most of my thunder. I so told him and thanked him very much for coming. He then informed me that he was sure that what I would say would only complement, supplement, and reinforce. So with that, I think it's probably the tone of what I'm about to lay on you.

I'd like to talk about devices by showing you perhaps one of the Army's very best with this slide. It's a cartoon from the Army Times. That's a tank on the left and strapped to the gun tube is a bloody bayonet, perhaps one of the better devices we've ever had. It's a simple device, quite realistic, it's affordable, and I can assure you it's durable and maintainable.

Among the many challenges facing the U.S. Army as we begin an unprecedented force modernization in the 1980s, described quite well by General Otis, none is greater than training the soldier and the crew on how to operate, maintain, shoot, and then fight. I put those four categories quite deliberately because we have to do more than just maintain it, operate it, and shoot it. We have to be able to fight with it. So those are the four things it seemed to me that we need to be able to do with a given piece of equipment. This would be a challenge even with unconstrained resources, but when we face a situation as we do today, wherein one out of every three dollars spent on training represents training ammunition alone, it's readily apparent, I believe, that all of us, both in and out of uniform, must find much less costly ways to train, yet simultaneously find ways to train more effectively.

A legitimate question I think all of us need to ask is can we achieve those goals. I would be the last person in this room to tell you that I think we are achieving them right now. I don't believe that. But I'd also be the first person to tell you that I think we simply must. We have to get on with that show.

Throughout the course of this conference, I know that you are going to hear that theme repeated by trainers of all Services time and time again. And we have to simply face up to the fact that training costs are rising more rapidly than we can put a finger on. I mentioned the soaring costs of training ammunition. Frankly, I think it's rather shocking. Let me give you just a few examples. Take the 5.56 ball ammunition - the little thing you shoot out of an M-16. Just a couple of years ago, each of those rounds cost 6¢. Today that same round costs 24¢ - four times more in just a two-year gap. This comes in the face of an increased effort on the part of the Army to not only emphasize marksmanship more than we have in the past decade, but also to stiffen the qualification requirements. Consequently, we're going to buy 129 million rounds of that little thing in FY83 alone at a cost of $31 million. That's not peanuts. On the other hand, if we had bought that same amount that we're buying



"Well, sir, what would you suggest fc. [illegible] during an ammunition shortage?"

in FY83 back in FY81, we could have gotten the whole thing for just $7 million. That's the kind of increased cost I'm referring to.

Let's take a 105mm tank round, if you will. That round costs today about $353. We fire on the average of about 110 to 140 rounds per tank per year in the active Army and around 60 rounds per tank per year in the reserve components. The 120mm round for the M-1 tank is going to cost almost $2,000 a round. Can you imagine us firing that many as we're doing today at $2,000 down range per round? We're trying to buy right now $77 million worth of that. Just one 25mm round for the new Bradley Fighting Vehicle comes to about $55 a round. That thing is like a vulcan. It has a very rapid rate of fire. We're in a real negotiating contest right now within the Army community trying to establish how many rounds do we have to plan for to be able to qualify a new gunner, a new tank commander, with that weapon system because we're very quickly pricing ourselves out of the training business. The best estimates we have today and what we're programming for out in 1984 for that round, we're buying $127 million worth, and I'm not a bit comfortable that we've really got a handle on the full total requirement.

Take the 2.75 inch rocket for the Cobra helicopter. That costs $300 each and they can ripple off about 30 of those faster than the eye can follow. We were very fortunate in years past in that we were able to use rockets that we had in excess of war reserve requirements. However, we're now having to pay the piper. In 1982, we're buying $85 million worth of that and in 1983, we're going to have to cost it up to $103 million and we still are only going to provide the Army about 40 percent of what the troops in the field feel is the minimum requirement.

The original cost of a tow missile was around $3,100. Today, we're talking of $7,500 - that's for one missile. In the past, we've been able to afford most crews one missile per year in addition to all of the simulating training they've had in order to fire to gain confidence to know that that system works. I dare say that in the future, those days are going to go. I doubt at $7,500 a round we're going to be able to afford even one round per crew per year. What are we facing there? First of all, a very poor simulator, one that does not give the soldier confidence in the M-70 because it's not a very good diagnostic and it doesn't tell him he hit or missed the target. I foresee very candidly many tow gunners firing their first live missile at a real Soviet tank if we ever went to war. And I wouldn't want to be in his shoes because I would think the adrenalin would be pumping right out of his eyeballs.

There's no question that the cost of training soldiers is just increasing astronomically. If you take the 440 new systems we're talking about, as General Otis described in the process of reorganizing and modernizing the Army, about 130 of those systems

all have shoot on them. You can see where we're headed and right now we're talking of about a $10 billion bill just for training ammunition alone. When you add to that the growing cost of fuel to train on the real equipment, the growing cost of land acquisition to get these ranges General Otis was talking about, modernizing the existing ranges or adding new ones, and then you take the increasing cost of just the spare parts it takes to maintain the operational fleet of equipment, the costs are mind boggling.

Let's look at some more examples. It cost $275 for one . . . . ., the anti-tank weapon. We have a good subcaliber device for that weapon, though, because we couldn't afford $275 for every soldier to learn how to fire it. So we designed one that cost only $27 per firing. Very cost effective. What happened to the Viper, which is going to be the weapon system to replace the LAW. $1,300 per viper. It's supposed to be an expendable round. How many Vipers can we fire to teach the soldier how to shoot it accurately at $1,300 per copy? So we understood that and we developed a training device, a subcaliber for the Viper also - and guess what it costs? $1,300 - we didn't save a nickle. Flying hour costs - only $209 to fly a Huey helicopter for one hour. It's going to cost $675, however, to fly the Blackhawk, the UH-60, for one hour. An M-60 tank cost about $182,000 when it was first produced in 1960. The M-60 A-3, cost $1.2 million in 1981 constant dollars, and the M-1 is coming in with a price tag of about $2 million. The M-2 and the M-3, the Bradley Fighting Vehicle comes in at about $1 million.

We have designed the conducted fire trainer to help us out, particularly with the M-60 A-3 and the M-1. We're talking there of a training device of about $1 million each. The basis of issue plan right now, which is still being debated, is one per battalion and that's why it's being debated. When you add up all the armor battalions and you multiply by $1 million each, perhaps we've priced ourselves out of business. Those are not exactly bargain basement prices by any standard.

The basis for finding more economical but just as effective ways to train is quite evident. The means to do that, though, are sometimes not quite as evident because they're not limited just to the aids and devices and simulators as substitutes for live ammunition. I believe from where I view life as the Director of Army Training that we need a formula that will do about four things. First, the Army needs to continue to work to develop better rationale to determine the quantities and the types and calibers of training ammunition - and I set training ammunition as a separate category from war reserve stock - to come up with better rationale for what do we really need in the way of minimum essential ammunition to attain and then sustain an acceptable level of performance, particularly with the people we have as they pass in and out of units, which is a function, frankly, of the fact that 40 percent of the Army is overseas,

60 percent in the States, and you need a 50/50 mix. Second, the entire Army uniformed community, as General Otis also pointed out, is making a great effort to search to find the optimum mix of training devices and training techniques so that we can, in fact, husband some of that live ammunition requirement. Third, and quite obviously this is one of the top priority programs, we simply have to find ways to use less ammunition than we have enjoyed in the past. Fourth, given the fact that ammunition costs are not going to decline - at least not on your watch or mine - we have to make maximum use of these various devices that we're all talking about.

Before turning to what the Army has done and what I believe the Army/Industry team needs to do in this effort, I believe it is important to all of us that we understand just a little bit, primarily from the designer as well, the training environment. We've got essentially two parts to the puzzle. One, the institutional training or that training done in the centers and schools in a very fixed environment. The second is in the unit.

The soldier will spend perhaps 10 percent of his time in that institutional environment. You've got great order in those institutions, relatively elaborate facilities, expert instructors, an opportunity to make maximum use of the aids and devices available, and trained operators to operate the same devices and very skilled people to maintain those devices. In other words, an advanced method of instruction across the board, and it's done in a relatively stable environment. The focus there, of course, is individual training.

The other 90 percent of the soldier's time, however, is spent in the unit where the focus is not only on individual training but also an equal focus on collective training. The instructors themselves, for the most part, are junior officers and noncommissioned officers. They're not the skilled instructors you would find in the institutional base. They are not experts, by any stretch of the imagination. They have to be taught how to train and what to teach before they are capable of training and coaching soldiers effectively. Operational equipment, rather than devices, is ordinarily used as the prime training aid and the facilities and methods of instruction are relatively basic - nothing fancy and no frills. The unit commander out there is responsible not only for the collective training, but he still has that entire wrap-up of the individual skills that the soldier has already attained in the training base and he is required to sustain those at the same time he is also required to teach him additional skills that the training base does not have the capacity to get across.

Most of the soldier's time in this Army is in that unit. That's where he does the majority of his learning and that's where he either retains it or his training decays. So unit leaders themselves are faced with the ultimate training challenge.

Limited ammunition - and it's going to become more limited - limited fuel allocations, monumental environmental problems, World War II size training areas and training ranges, which frankly are unable to accommodate most of our new weapons capabilities. Yet that unit commander has very specific language to attain and sustain a level of training effectiveness so if his unit goes to war, he can not only fight but he'll win.

All of us in this room well know that that's not a new challenge to the Army or to its unit commanders. We have made considerable progress, I believe, in providing him some of these training resources. Many of you in this room deserve great pats on the back for those same successes. But frankly, our track record collectively could be and should be better. The process for delivering a device often spans three generations of uniformed action officers. You know what happens each time they change the guard on the Project Manager or somebody who is trying to integrate a system into the overall systems. Need identification, concept, TDR, development tests, evaluation, acceptance and fielding - sometimes it seems to be the means in and of itself. I can recall when I was the Chief of Tactics at the Infantry School at Benning, great discussion centering around the target system we now call the AHRETS. Here we are 10 years later and the AHRETS is just now beginning to be fielded and I confess to you that I, for one, have never seen one face to face. I've seen only photographs, but I take someone's word that it really works. How long have we had the DRAGON anti-tank missile system? And how long have we needed a really effective training device to simulate the firing of that system? About eight years. We are just now beginning to start looking at fielding the STAG and I think many of you have probably seen that on a display. Don Campbell and his people tell me that even though we are at that stage, it will be at least another two years before the STAG is actually fielded, and that's with DRAGON already about mid-way through its life cycle.

Now, that's not to imply that the Army does not enjoy some excellent devices and simulators. Indeed, many are absolutely super. The WEAPONEER is a prime example of how to train soldiers better and faster and cheaper. The WEAPONEER, which cost only $35,000 a copy, will pay for itself usually in less than a year. The Observe Fire Trainer is another excellent device which saves us great ammunition dollars, much artillery ammunition, and trains the forward observer perhaps better than we can in some respects with live ammunition. Our Rotary Wing Flight Simulators are saving us countless training man-years, as well as flying hours and flying dollars. The fairly simple UH-1 Huey helicopter instrument trainer, of which we have about 22 located world-wide in about 17 locations, to the simulator for the AH-1 attack helicopter and the new simulator is coming along for the AH-64 attack helicopter, we're able to simulate through computer imagery sufficient battlefield realism that when the pilots finish the simulator, I assure you most of them have great

patches of sweat across their shoulders and dripping right off the palms of their hands.

Our REDEYE and our STINGER, our hand-held antiaircraft, anti-missile defense systems, are qualifying people with the moving target simulator at enormous savings, particularly when you figure that in the years to come, one STINGER by itself will come to $50,000 a round. Without the moving target simulator, we'd never make it.

General Otis and General Miley have both mentioned the business of training the maintainer or the repairer. There is a study being conducted at Fort Leavenworth called "Man-Machine Interface." It's about eight months down the road and they have another four to six months before they complete it. They are examining many of these same new systems that we're talking about to see if, in fact, the ordinary mortal is going to be able to operate it, fight it, shoot it, and maintain it. Not surprising - and again, it falls exactly within what General Otis and General Miley referred to - it is simpler to operate it, it's simpler to fight it, it's simpler to shoot it, but it's a son of a gun from the standpoint of maintaining it. We have a long, long way to go before we're able to do that. It does us little good, of course, to have millions of dollars worth of equipment sitting off in a motor park somewhere because we can't maintain it. We have designed, for example, field test sets which are able to diagnose what's wrong with the various black boxes. When we did that, though, we should have also put some behavioral scientists to work on how to maintain the field test set, because that in itself is a real rascal to maintain. We don't have right now the skills to do that.

The 14.5mm subcaliber device for artillery is a grand example, I would submit to this audience, on wrong-way lessons learned. A device designed to conserve artillery training ammunition. It has had some excellent use, but on the other hand, most artillerymen choose to ignore it as best they can. Why? It doesn't give the crew a full day's training as a crew. It doesn't have a pop, bang, smoke. It's very susceptible to winds so the ballistics of it are such that when an FO is being trained on it, everyone understands that it's not necessarily going to be the proper adjustment and because it lacks that realism, the artillery redleg guys are the first to keep it in the back end of the training area support shops.

Those days are fast diminishing because of the cost of artillery ammunition and like it or not, the artillery is now having to go out and use it more and more frequently. But I will assure you, they don't like it.

Fortunately, we can balance those kinds of cases with some tremendously smart innovations. General Otis mentioned the National Training Center. One of the greatest one-on-one events we have out there is this MILES Simulated Engagement System. I think MILES probably will do more to teach tactics than anything we

have had in the history of warfare. Not just in this man's Army, but any Army. Properly employed, MILES is the greatest single device the poor walking foot soldier, as well as that individual tank commander, has ever gotten his hands on. Contractor support - and MILES is going to really get its work-out in that desert at Fort Irwin.

What can the Army and industry do together to meet our mutual challenges? First of all, I think we should start by agreeing just what is a good training device. From where I view it, it seems to me it should have several common characteristics. It has to be available and must be ready to be used repeatedly - not one at a time. It can't be that maintenance sensitive. In other words, it has to be durable and it has to be able to withstand the unique way soldiers apply Murphy's Law. If it breaks down easily, that soldier is going to lose his confidence in it, as his commanders will, and it becomes a back shelf item. It's the kind of a thing where you've got the soldier in the desert. If you took the ordinary soldier at random and by himself you placed him out in the middle of the Mojave Desert and you gave him a five-gallon can of water and enough food for seven days, you gave him a shelter half so he could construct some shade and you gave him an anvil. If you came back in three days, he will have consumed all the water, he will have eaten all seven days worth of rations, he will have put the shelter half up for shade, but he won't be underneath it. He will probably have befriended some animal and it will be in the shade while the soldier suffers in the sun because he feels sorry for the animal. I will guarantee you he will have broken the anvil. It's that simple. We need to understand his way of applying Murphy's Law.

The next thing I think any good training device must share is that it has to be simple to operate. It can't be that complicated. It's like the old sergeants used to say, we have some great equipment made by geniuses to be used by idiots. I'm not trying to put myself in the latter category, but I've been known to break a few myself. It obviously must provide the most realistic training possible and balanced with that, it's got to be affordable. We have to watch ourselves because we're about to price ourselves out of business. We have to look at those costs very, very carefully because those costs, I will assure you, are always under stringent analysis and challenge by your OSD Budget Analysts and your OMB Budget Analysts and the GAO and the Congress. It must be a major contributor, not a marginal contributor, to better training. That's sort of obvious, but sometimes when we get off on a tangent and we look at the long-range cost effectiveness of the system and try to look at that pay-off, we don't always achieve it.

Again, I want to reiterate the four things it has to be able to do. It has to help us, as either individuals or crew members, operate the equipment, maintain the equipment, shoot the equipment, or fight the equipment. The more of those four it can

do, the better it is. The second thing, I think is that the Army itself has a responsibility to identify as early as possible in the development cycle the kind of training device we need and make sure that that device is fielded in a timely way with the end item in itself. Where are we in that same schedule for the M-1, the M-2, the M-3. It's not exactly that the M-1, M-2, and M-3 snuck up and surprised us that we were about to produce them. I've known about it for years and years. I don't know where the fellows who were doing the training devices were, though, when that was advertised.

Third, I think the Army needs to take a much closer look at the life cycle management model to find ways to ensure that the material developers, combat developers, and the training developers are all in sync and are meeting decision milestones, and that they come up with a commonly agreed series of those milestones. Above all else, the Army simply must find a way to shorten that process from conception to delivery to the user.

Fourth, industry for its part, I believe, needs to come on line early on and give the Army a very blunt and a very pragmatic assessment of the device early in that development stage, applying those same parameters and criteria I just described. It makes good business to sell that thing to the user rather than the middle man.

Fifth, industry can develop total systems, presenting it to the Army.

In sum, the Army and industry must be partners in training those soldiers and those crews to fight. It can't be just the Army men in green suits. We have to work that problem together. And I think if we do work it together, I'm convinced we can meet the challenges of developing a tough Army: one tough enough and skilled enough in both individual and collective tasks; one that can be trained and at the same time conserve resources by maximizing the uses of those devices and simulators. In short, an Army which all of us together can be totally confident is both physically and psychologically ready to go fight globally and win. And gentlemen, that's where I, as Director of Army Training, am coming from on the training device. Thank you.

Since this is apparently one of my additional duties as the Army moderator, I'm going to be introducing the users and training experts from the other three Services. We're going to lead off with the Navy, to be followed by the Marine Corps, and followed by the Air Force.

I would like to first introduce Rear Admiral Ed Hogan, Naval Academy class of 1954, who is the Director of Aviation Manpower, Training, and Aircraft Carrier Programs. During his 27 years of service, he has had extensive Command duty to

include skipper of the USS KITTY HAWK and skipper of the USS KAWASHIWA. He's a member of the Society of Experimental Test Pilots and a Trustee of the Naval Academy Foundation. It's a great pleasure to introduce to you Rear Admiral Ed Hogan.

Rear Admiral E. J . Hogan

Thank you for the kind words, General.

Looking at this podium up here today when I walked in the auditorium, I wasn't happy with having to come up here and speak with that sign underneath there. But then as I listened to General Meloy talk, I understood a couple of things. One, why why they brought Pete Dawkins back to the Army Staff; two, why they delayed the Army-Navy football game in Philadelphia until this upcoming weekend, and recognized the serious problems the Army has. Ladies and gentlemen, whether you know it or not, the real reason you're here is to develop a simulated football team for Army. I wish you luck in that, but I don't think you have a change.

I want to thank ADPA for inviting us here today to give a little bit of an overview of the Navy's training needs. We're going to have a sort of troika presentation. I'm concerned primarily with the airplane side and in particular with the flight training simulation. I'm going to be followed by LCDR Bruce Lemkin, who is our submarine representative who works for Admiral Rickover and in this instance, aviation seems to have a little bit more money than the submariners and I'm also a little bigger than he is and that's why I'm leading the troika. Then the surface community is going to follow with a brief presentation by Dr. Henris. We're going to be talking very quickly. It will be a little like taking a drink out of a fire hydrant. You'll probably get more on you than in you, but we're trying to put up some thoughts here and I think that you'll be able to come back on Wednesday at the user panel and critique our presentation.

We've come a long way in aviation training since the blue box that you see here of the 40s and 50s, and I hate to admit that that's the first simulator that I ever flew in going through flight training in Pensacola in the mid-50s, and it did a super job. It was very simple, it was task oriented, it taught you how to fly instruments. It had an objective and it helped you to reach that objective. We have quite a bit of benefit from that device. We could produce it in quite large numbers, it was relatively inexpensive, and we ended up training some 500,000 aviators on it during the 40s and 50s. We were able to actually use that device again in a functional mode and get a job done. From that basic beginning, we've come to a new dimension of simulation. It's a state-of-the-art embodied in the air combat trainer. It has great fidelity in terms of the simulation it does. It also costs quite a bit, and as the Army

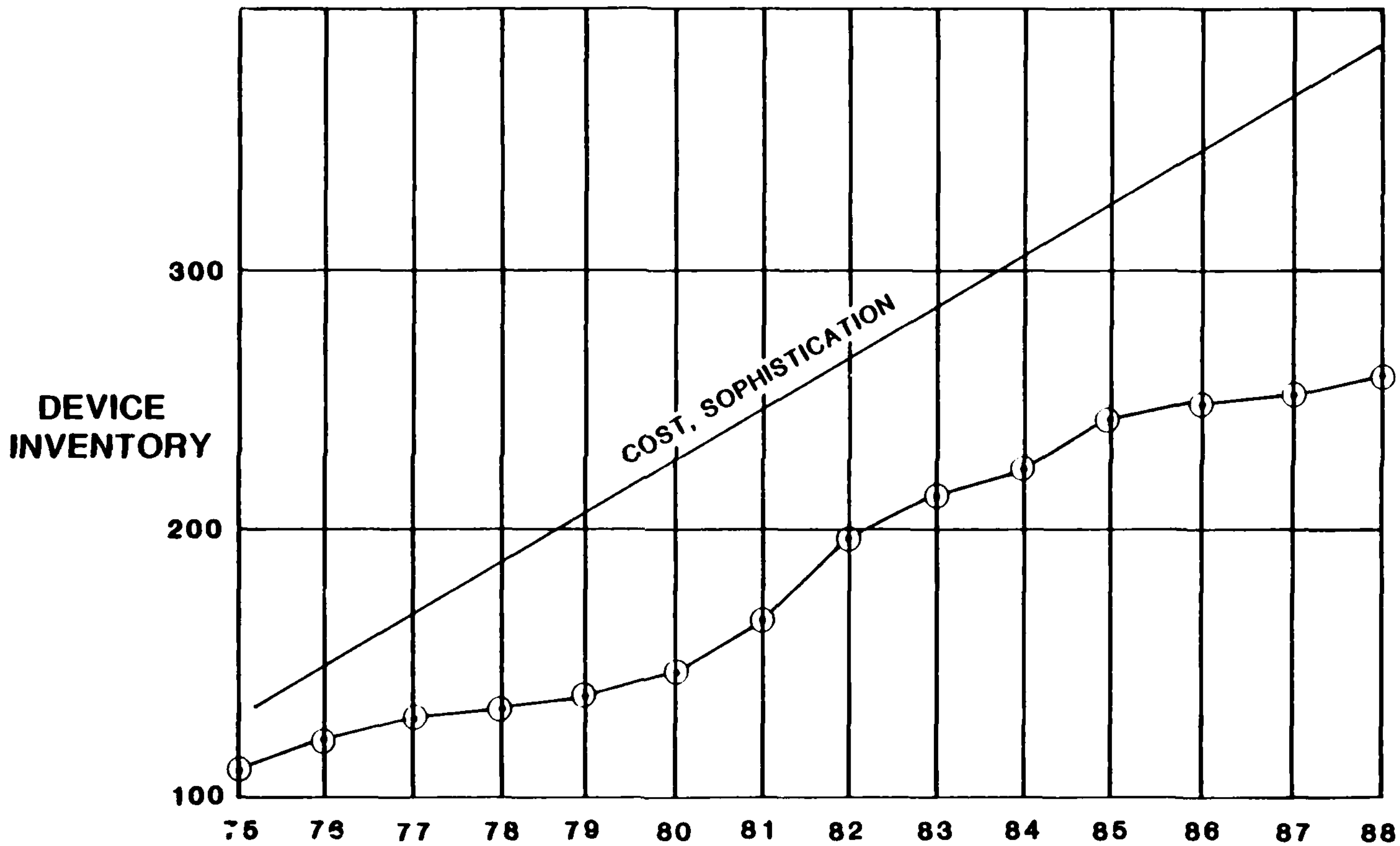
user previously mentioned, it's extremely difficult to maintain, has a long production cycle, and there's a lot of problems as we move into this greater sophistication. As we move on, we're getting more and more numbers of devices and they're costing us more and more. As General Meloy ably presented, it's extremely difficult to get the job done today because of those cost considerations. We're looking for ways to give our people the best possible means to learn their equipment and to be able to fight their weapon systems. We're asking you to help us in these endeavors and we're asking you to give us your perceptions on how best to do that. We want to look at the total system, however, and I think it's important that we look at the priorities that we have as we procure these devices.

The primary thing that we're trying to do with these systems is improve the combat readiness of the force. We're trying to get the individual trained so that he can fight, and the proof of the pudding is going to be in the fighting. I think we're doing pretty well in this arena and I think the recent events in the Gulf of Sidra in the Mediterranean more or less indicated how well we're doing in terms of the combat readiness of a particular weapon system, the F-14 in that case. So we are getting trained, capable people out there. The system is performing well, it is maintainable, so we're seeing some good return in the way we're going. We're seeing improvement in flight safety. Accident rates are the prime measure of this. We can give some of this improvement to our operations across a broad range of training. And finally, we're trying to take the hard approach that was previously mentioned - we're trying to do this in the most efficient way and trying to hold those operating costs down.

Here is where we're coming to in the 80s, what we're trying to do in naval aviation in terms of our priorities for procuring these devices. We're trying to support the emerging aircraft. We will see a strong need for a total system support for these emerging systems. Secondly, we're trying to put our dollars in the area where we can approve the existing systems that we have and finally, develop new systems for older aircraft. I think naval aviation has really been in the forefront of developing a system concept of training. I think we have recognized that the prerequisites for combat readiness are embodied in the training we give our individual air crew and maintenance people, and we recognize that the foundation of knowledge that is required is the base on this. We must not only teach people how to operate; they must understand what they're doing. They must understand the system's architecture and they must be able to apply it. So, we're really in the education business in its fullest sense. We're trying to use the full range of available modern devices and systems to do this.

This is a listing of some of the systems that we are going to be looking at during the fit-up years. They're already on the books; we're already procuring them. It's my job, as the

DEVICE PROCUREMENT COSTS GREATER THAN $500K



AVIATION TRAINING DEVICE

PROCUREMENT OBJECTIVES

1. MAINTAIN AND ENHANCE READINESS
   - SUPPLEMENT, NOT SUBSTITUTE
2. IMPROVE FLIGHT SAFETY
3. CONSERVE RESOURCES
   - MAINTENANCE MANHOURS
   - OPERATING COSTS

AVIATION TRAINING DEVICE

PROCUREMENT PRIORITIES

1. SUPPORT FOR EMERGING AIRCRAFT

2. MODIFICATION TO EXISTING DEVICES

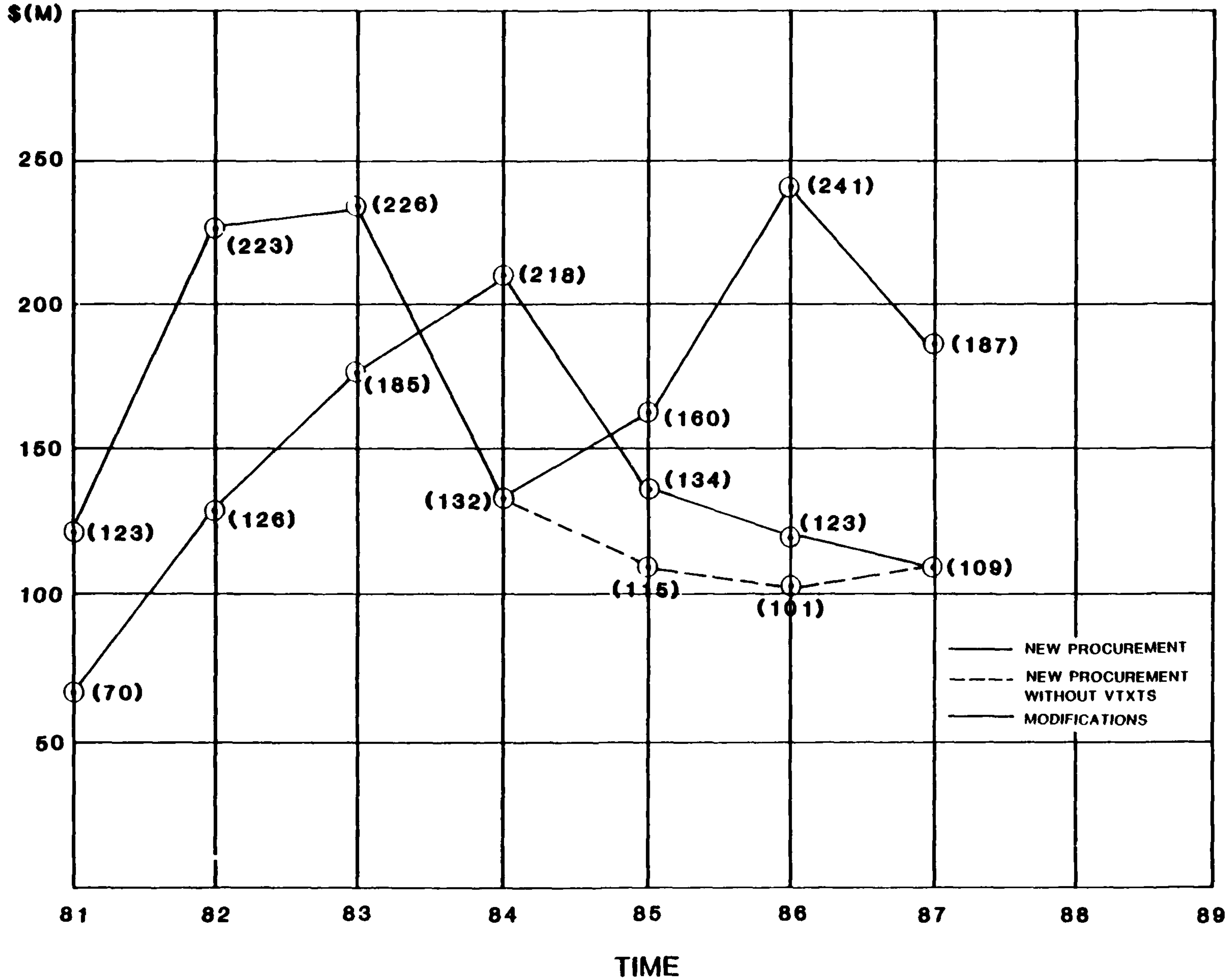
3. NEW EQUIPMENT FOR OLDER AIRCRAFT

PROJECTED NEW PROCUREMENT

FY 1983 - 1987

1983	1984	1985	1986	1987
F/A-18 OFT, WTT	F/A-18 OFT, WTT	F/A-18 OFT, WTT	F/A-18 WTT	F/A-18 WTT
AV-8 AST	AV-8B OFT	AV-8B WTT		
EA-6B LCCPT	AH-1T WST	A-6E PTT	VTXTS	VTXTS
P-3C WST	TH-57 FIT(3)	ECX OFT		
A-7E VISUAL FOR WST		H-2 WST	H-2 WST	H-46 OFT
TH-57 FIT(3) CPT(2)			H-2 SOPTT(2)	

NEW PROCUREMENTS VS MODIFICATIONS



middle man, if you will. I must point out that I'm really not the end user of these systems. The end user is the young pilot that we're training and the people who are actually in the field training them. I'm more or less the bureaucratic interpreter of those requirements and I try to put them down so that we get the money into these systems and help the people in the fleet do a better job and become more combat ready. One of the things I try to do in the Pentagon is actually do the talking and try to get the monies put into these systems so that we have them for the men who need them. We need your help in doing that because, as I pointed out earlier, the systems are expensive, they're difficult in the broadest sense to bring into being. We're spending millions of dollars on devices. What we're really trying to do is get the most efficient use of the available resources that we have. And you almost can go back to the economic theory of marginal cost and marginal return, and we're trying to make these devices so that we get the most training we can out of them and in an affordable fashion.

We've talked about the problems. I think these are pretty much across the board of the Services. We've run into these specific things in recent years - late delivery, overcost is a big problem. A lot of this is our own making. We've had problems in defining the requirements precisely and getting them out in terms of specifications to industry, and so we all have to work together in improving that situation. Those of us in this room have become more or less a regulated industry. I look at our contracting officers in the Services as almost like the commissioners of a public utility commission. Most of the things that we're doing are cost oriented with a reasonable profit attached to it. We have to get control of those costs and get some productivity in the production of these systems so that we get them on time and in a fashion that we can use. They've got to be maintainable and reliable, as previously mentioned, and of course the utility function is one that we're really trying to come to grips with in terms of what it is we're trying to do. I think the focus has got to be on that learning objective of teaching the individual how to operate and maintain and, as previously mentioned, fight the particular weapon system we're involved in.

We're trying to address the current problems and make the corrections we need. We're trying to come in with a better total systems approach to this problem. It's my view that we have tended to fragment our training systems on a functional basis and have lost sight of the real objective of why we buy them in the first place. The systems are there to support the original weapons systems, not to replace them. It's got to be put into the perspective of a total systems approach to training and operating our systems in the fleet.

That briefly sums up where we're coming from. I hope we can get some of you to come in early Wednesday and talk to us

PROBLEMS

CURRENT AND CONTINUING

- **DELIVERY - LATE, OVER COST**
  - CHANGE IN WORK STATEMENT
  - ECP
  - LATE GFE
  - SCHEDULE
  - SITE PREPARATION
  - ESTIMATES
  - BUY IN
- **MAINTAINABILITY/RELIABILITY**
  - CONTRACT MAINTENANCE/OPERATION?
- **MARGINAL UTILITY**
  - CAPABILITY/COST VS TRAINING TRANSFER
  - MOTION, VISUAL
- **SPECIFICATIONS NOT BEING MET**
- **SLEP/CILOP - DRIVEN CHANGES**
  - MODIFY OR NEW PROCUREMENT

USER VIEW FUTURE EFFORTS

- CONTINUE TO ADDRESS CURRENT PROBLEMS
- PROCURE TOTAL TRAINING PACKAGE FOR NEW AIRCRAFT
- COMPUTERIZED MANAGEMENT OF TRAINING PACKAGE
  - OPERATOR
  - MAINTENANCE
- CONTRACTOR SUPPORT IN SCHOOL HOUSE
- INCREASE SIMPLE, LOW COST TRAINING DEVICES
  - MARGINAL TRAINING RETURN ON INVESTMENT
  - RELIABILITY/MAINTAINABILITY/AVAILABILITY
  - ON TIME DELIVERY WITHIN COST

on your side of those problems that I just brought up and give us your views so we can take them back to the hallowed halls of the Pentagon.

I'd now like to introduce my compatriot who's going to follow on in talking about the submarine side of the house, LCDR Bruce Lemkin.

LCDR Bruce Lemkin

Thank you, Admiral Hogan. Good morning ladies and gentlemen. I'm LCDR Bruce Lemkin; I'm a submariner, currently serve as the Head of the Combat Systems Training Section in the Submarine Manpower and Training Division on the Staff of the Deputy Chief of Naval Operations for Submarine Warfare.

This morning I'll briefly discuss submarine training, where our present program is, major problems we face in the training area, and some items to consider for future developments in submarine training.

The Deputy Chief of Naval Operations for Submarine Warfare, OP-02, is the sponsor for all submarine programs. OP-02 contains divisions with cognizance over strategic submarine programs, attack submarine programs, deep submergence systems, and one of primary concern here, submarine manpower training, OP-29. OP-29 is the sponsor for submarine training programs, including pipeline training, maintenance and operational training, and on-board training programs. The primary goal of the submarine training community is to provide a sufficient level of prerequisite training to an individual before reaching his submarine such that he can function as an effective crew member from the time of reporting aboard. It is also our goal to conduct as much shore-based submarine training as possible in the home ports of our ships; thus, our primary training sites are New London, CT; Norfolk, VA; Charleston, SC; Pearl Harbor, HI; San Diego, CA; Bangor, WA; and Kings Bay, GA.

Let's turn to the present submarine training device program. The submarine navigation and piloting trainer will be capable of training in both surface and submerged navigation and piloting, including visual, radar, and electronic navigational techniques. Computer-generated imagery and radar land-mass simulation are integral features of this trainer. The submarine damage control trainer will contain a realistic duplication of submarine lower level engine room with flooding features. Included is a closed circuit TV system for instructor monitoring. Submariners will face potential catastrophic casualty situations where prompt action is required to save the ship.

The advanced visual near-visual electro-optic sensor simulator, known as AVEOS, will provide tactical electronic warfare

DCNO (SUBMARINE WARFARE)
OP-02 ORGANIZATION

OP-02
VADM N.R. THUNMAN

OP-02B
RADM A.B. SCOTT, JR.

OP-21
STRATEGIC SUBMARINE DIVISION
RADM F.B. KELSO II

OP-22
ATTACK SUBMARINE DIVISION
RADM D.M.SMITH

OP-23
DEEP SUBMERGENCE SYSTEMS DIVISION
RADM D.M. SMITH

OP-29
MANPOWER AND TRAINING DIVISION
CAPT W.P. CHASE

SUBMARINE MANPOWER AND TRAINING DIVISION
OP-29 ORGANIZATION

OP-29
DIRECTION
CAPT W.P. CHASE

OP-291
REQUIREMENTS
ANALYSIS
BRANCH
CDR W.K. CASTLE, JR.

OP-290
TRAINING PLANS
AND PROGRAMS BRANCH
CAPT T.E. HUTT, JR.

OP-29P
ASSISTANT
FOR PLANS
AND PROGRAMS
MR. G.R. HORN

OP-290C
ATTACK SUBMARINE
TRAINING PROGRAMS
(COMMUNICATIONS, ELECTRONIC
WARFARE, NAVIGATION)
LT J.M. MILKE

OP-290D
COMBAT SYSTEMS
TRAINING PROGRAMS
(FIRE CONTROL, SONAR,
WEAPONS)
LCDR B. LEMKIN

OP-290E
TRAINING
PIPELINE
PROGRAMS
LTJG J.W. DOBBINS

PRIMARY SUBMARINE TRAINING SITES

- NEW LONDON CT
- NORFOLK VA
- CHARLESTON SC
- PEARL HARBOR HI
- SAN DIEGO CA
- BANGOR WA
- KINGS BAY GA (FUTURE)

SUBMARINE WARFARE TRAINING DEVICE PROGRAM

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
15F12		SUBMARINE NAVIGATION AND PILOTING TEAM TRAINER
	80	NAVSUBSCOL NEW LONDON (15F12A)
	81	FLEBALMISUBTRACEN CHASN (15F12A)
	81	SUBTRAFAC SAN DIEGO (15F12A)
	84	FLEASWTRACENLANT NORFOLK (15F12A)
	86	NAVSUBTRACENPAC PEARL HARBOR (15F12A)

SUBMARINE WARFARE TRAINING DEVICE PROGRAM
CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21C6		SUBMARINE DAMAGE CONTROL TRAINER
	81	FLEBALMISUBTRACEN CHASN (21C6A)
	85	FLEASWTRACENLANT NORFOLK (21C6A)
	86	SUBTRAFAC SAN DIEGO (21C6A)
	87	NAVSUBTRAPAC PEARL HARBOR (21C6A)

SUBMARINE WARFARE TRAINING DEVICE PROGRAM

CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21B66		**ADVANCED VISUAL/NEAR VISUAL ELECTRO-OPTIC SENSOR SIMULATOR (AVEOSS)**
	82	SUBTRAFAC SAN DIEGO AC #2
	85	NAVSUBSCOL NEW LONDON AC #4
	86	NAVSUBTRACENPAC PEARL HARBOR AC #3
	87	FLEBALMISUBTRACEN CHARLESTON AC #2
	88	NAVSUBSCOL NEW LONDON AC #1
21B65		**SUBMARINE ESCAPE PROCEDURE TRAINER**
		NAVSUBSCOL NEW LONDON

and advanced visual periscope training. AVEOS will be incorporated into our attack center trainers and will add a much needed feature to our shore tactical training capability. The submarine escape procedure trainer, to be single-sited in New London, will replace the near obsolete landmark escape towers in New London and Pearl Harbor. Submariners will be taught submarine escape procedures employing a diving recompression chamber and functional mock-ups of a submarine escape trunk and deep submergence rescue vehicle.

The 21B64 sonar operational trainer provides individuals and sonar teams training in a realistic ocean environment in the operation of the ANBQQ-5 series digital sonar system. As this system is the predominant sonar in our fast attack nuclear submarine fleet, this training is critical in ensuring that these ships are fully ready to carry out their primary mission of anti-submarine warfare. The update and modifications in this program result from tactical equipment revisions, as well as trainer improvements. The ANBQQ-5 trainer program most clearly reflects the difficulties encountered in keeping up on a real-time basis with the operational tactical program.

The submarine combat system team trainer program is the key to effective training in submarine approach and attack in a wide variety of scenarios. These trainers replicate the attack center on a submarine and place the crew in a realistic tactical situation. The full spectrum of submarine weapons from torpedoes to cruise missiles may be employed. Prosecution and attack of single and multiple surface and sub-surface targets is available. These trainers are currently being integrated with sonar team trainers to facilitate a maximum degree of fire control sonar party teamwork. The 21A43 series of trainers will be the primary means for training in TOMAHAWK employment.

A current research and development improvement to the combat systems trainer is the submarine advanced reactive tactical training system known as SMARTS. This system will realistically generate real-time dynamic anti-submarine warfare training scenarios based on known weapons system capabilities, operational environment, and tactical guidelines of both own and target ships. A key aspect of this system is its operator monitoring and evaluating capabilities to greatly enhance instructor effectiveness.

The multi-class advance ship control trainer provides shore-based dynamic training capable of simulating scenarios and problems involving submerged steering, diving, ballast control, and casualty control situations for 10 different classes of submarines. These trainers are vital to ensuring that submarine ship control parties are prepared to safely operate their submarines at sea.

The basic sonar operator trainer is a part-task device which gives the sonar operator trainee hand/eye coordination, knobology and display familiarization prior to proceeding to the more

SUBMARINE WARFARE TRAINING DEVICE PROGRAM
CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21B64		21B64 SERIES AN/BQQ5 SERIES SONAR OPERATIONS TRAINER (MODIFICATION)
	80	FLEABALMISUBTRACEN CHARLESTON
	80	NAVSUBSCOL NEW LONDON
	81	VARIOUS (8 DDM)
	81	VARIOUS (3 UPDATES)
	81	SUBTRAFAC SAN DIEGO
	81	NAVSUBTRACENPAC PEARL HARBOR (INTERFACE)
	82	VARIOUS (10 DDM)
	82	NAVSUBTRACENPAC PEARL HARBOR (UPDATE)
	82	NAVSUBSCOL NEW LONDON (INTERFACE)
	82	FLEASWTRACENPAC SAN DIEGO
	82	FLEABALMISUBTRACEN CHARLESTON (INTERFACE)
	83	NAVSUBSCOL (CONVERSION) (21B64B CONVERSION TO 21B64C)
	84	SUBTRAFAC SAN DIEGO AC #7
	84	FLEASWTRACENLANT NORFOLK AC #1

SUBMARINE WARFARE TRAINING DEVICE PROGRAM
CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21B64 Cont.		**21B64 SERIES AN/BQQ5 SERIES SONAR OPERATIONS TRAINER (MODIFICATION)**
	85	NAVSUBTRACENPAC PEARL HARBOR AC #2
	85	FLEBALMISUBTRACEN CHARLESTON AC #5
	86	NAVSUBSCOL NEW LONDON AC #6
	86	FLEASWTRACENPAC SAN DIEGO AC #4 (UPDATE TO REFLECT AN/BQQ-5C SYSTEM UPGRADE)
	87	FLEASWTRACENPAC SAN DIEGO
	87	NAVSUBSCOL NEW LONDON
	87	SUBTRAFAC SAN DIEGO
	87	FLEASWTRACENLANT NORFOLK
	87	NAVSUBTRACENPAC PEARL HARBOR
	87	FLEBALMISUBTRACEN CHARLESTON
	88	FLEASWTRACENPAC SAN DIEGO AC #4
	88	NAVSUBSCOL NEW LONDON AC #6

SUBMARINE WARFARE TRAINING DEVICE PROGRAM
CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21A43		SUBMARINE COMBAT SYSTEM TEAM TRAINER
	81	SUBTRAFAC SAN DIEGO
	82	FLEASWTRACENLANT NORVA
	83	NAVSUBTRACENPAC PEARL HARBOR AC #2, AC #3 (CONVERSIONS)
	84	NAVSUBSCOL NEW LONDON OT1, OT2
	84	NAVSUBSCOL NEW LONDON AC #3, AC #4
	85	FLEBALMISUBTRACEN CHASN AC #1, AC #2
	86	NAVSUBSCOL NLON AC #5 (MAJOR UPGRADES TO DV 21A34 BASELINE)
	87	SUBTRAFAC SAN DIEGO AS #1, AC #2
	87	FLEASWTRACENLANT NORFOLK AC #1
	87	NAVSUBSCOL NLON OT1, OT2, OT3, OT4
	88	NAVSUBTRACENPAC PEARL HARBOR AC #3
	88	NAVSUBSCOL NLON OT1, OT2, OT3
	88	NAVSUBSCOL NLON AC #5

SUBMARINE WARFARE TRAINING DEVICE PROGRAM

CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
		SUBMARINE ADVANCED REACTIVE TACTICAL TRAINING SYSTEM (SMARTTS)
	80	SUBTRAFAC SAN DIEGO
	84	NAVSUBSCOL NEW LONDON
	85	NAVSUBSCOL NEW LONDON
	85	FLEBALMISUBTRACEN CHASN
	86	FLEASWTRACENLANT NORFOLK
	86	NAVSUBTRACENPAC PEARL HARBOR
	87	SUBTRAFAC SAN DIEGO (UPDATE)
	87	NAVSUBSCOL NEW LONDON

SUBMARINE WARFARE TRAINING DEVICE PROGRAM

CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21C7		MULTI-CLASS ADVANCED SUBMERGED SHIP CONTROL TRAINER
	83	TRITRAFAC BANGOR (21C10 CONVERSION)
	84	NAVSUBSCOL NEW LONDON (INCLUDES RETROFIT)
	85	NAVSUBSCOL NEW LONDON (RETROFIT SUBTRA FAC SAN DIEGO)
	86	NAVSUBSCOL NEW LONDON (RETROFIT FLEBALMISUBTRACEN CHASN)
	87	NAVSUBSCOL NEW LONDON (RETROFIT FLEASWTRACENLANT NORFOLK)
	88	RETROFIT NAVSUBTRACENPAC PEARL HARBOR

SUBMARINE WARFARE TRAINING DEVICE PROGRAM

CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
14E31A		**BASIC SONAR OPERATOR TRAINER (AN/BQQ-5C)**
	84	FLEASWTRACENPAC SAN DIEGO
7B3		**SUBMARINE ADVANCE SIGNAL TRAINING SYSTEM (SASITS)**
	81	NAVSUBSCOL NEW LONDON (MOD)
	81	NAVSUBTRACENPAC PEARL HARBOR (2 UNITS)

complex sonar team trainer. This approach has proved to be very cost effective. The submarine advanced signal training system will provide a realistic electromagnetic environment to submarine operators for various programs.

The Mark 117 basic fire control operator trainer facilitates training of attack submarine weapons control console operators in all displays and capabilities of these equipments in preparation for functioning as an integral part of the fire control and battle stations parties. The ESM radar signal simulator will be a portable trainer, able to provide simulated radar signals to two operational shipboard ESM systems simultaneously, thereby enhancing inboard/onboard training capabilities in submarine electronic support measures.

That, then, is the present ongoing submarine training device program. As you can see, it is both extensive and diverse. There are several key problem areas that call for addressal.

In this era of fiscal belt-tightening and close perusal, affordability is the key factor to a program coming to fruition and continuing. Escalating costs for particular training devices raise the question, are the benefits worth the cost? Trainer-unique equipment maintainability is a continual, expensive problem. Contractor support services are often required because Navy personnel frequently lack the knowledge and experience to maintain these equipments. Failure of these and subsequent lengthy repair times cause perturbations in pipeline training and create negative attitudes towards the training device by the user. In fact, fleet readiness may be directly detrimentally affected when a particular trainer is not available to support such training as that required for pre-deployment.

Over-complexity in training devices has become quite apparent. Trainers have evolved seemingly without regard to definitive requirements. For example, on our sonar and fire control systems, we have developed a multitude of highly complex software programs for simulation of a realistic ocean environment. The proliferation of these various oceans has produced inconsistencies in training and has produced incompatibility in what should be a common area. Despite our level of complexity and sophistication, the instructor is relied upon to monitor the students and effectively evaluate and critique their actions. As in other personnel areas, instructor assets are tight. Our present trainers do not assist the instructor as effectively as they should. Our ability to conduct meaningful onboard training on present complex fire control, sonar, ESM, and associated systems without detracting from the ship carrying out its mission is limited. Common sense shows that training the people on the ship with the equipment that they will actually operate should be a most cost effective, time effective means of training. While we have made some

SUBMARINE WARFARE TRAINING DEVICE PROGRAM
CONTINUED

DEVICE NO.	FY	PROJECT TITLE AND LOCATION
21B63A/B		MK 117 BASIC FIRE CONTROL OPERATOR TRAINER
	80	NAVSUBSCOL NEW LONDON
		ESM RADAR SIGNAL SIMULATOR
	82	FLEBALMISUBTRACEN CHASN
	82	NAVSUBTRAFAC SAN DIEGO

progress in training onboard to the maximum extent, our present onboard systems, as I said, are limited in this area. As we have seen, add-ons to improve this situation prove expensive and frequently not feasible due to submarine space limitations.

These areas are fertile ground for future development and investigations by the organizations represented here today. As mentioned previously, our trainers often are too complex, they're too costly and they fail to satisfy fleet needs. The first step to correct this is to define requirements. But we still do not have a fully adequate means of doing so. We need help in this. Future training devices should then be no more complex than is required. They should be maintainable by Navy personnel with a minimum of training. Part-task trainers, such as the ANBQQ-5 basic sonar operator trainers, show the effectiveness of the less complex approach. Trainer-unique equipment such as that comprising the master simulation computer group should move towards commonality for all trainers. Future trainers must be able to accommodate subsequent operational system improvements with a minimum of impact.

In defining requirements, the desired degree of realism should be carefully determined. Again, this aspect should not exceed what is really required.

Measures to facilitate performance evaluation and critiquing in the trainer must be incorporated at the onset of trainer development. And probably most important, onboard operational systems should be designed with an embedded training capability as comparable as possible to what we see now in the shore-based trainers. The possibilities for expanded onboard training are many. Current technology and attitude are highly supportive of it, and if one area could be called the wave of the future in submarine training, onboard training is it.

The submarine training device program is a dynamic and extensive one. While we are striving to meet the needs of our submarine force to maintain a maximum level of readiness, we are anxious for new ideas and methods to do our job even better. We will appreciate your help. Thank you.

I'd like to now introduce Mr. Jim Henris, who is a representative of the Surface Warfare, Manpower, and Training Division, OP-39.

<u>Mr. James Henris</u>

Thank you, Bruce, and good morning. It's a pleasure to be here this morning to talk on the subject of surface warfare training and where we're going. My approach will be to address very briefly the sponsor's goals, OP-39, a little bit about how we do business, and finally, the directions as we see surface training evolving.

PROBLEM AREAS

- ESCALATING COST
- TRAINER–UNIQUE EQUIPMENT MAINTAINABILITY
- TRAINER COMPLEXITY
- PERFORMANCE EVALUATION/CRITIQUING LIMITATIONS
- ONBOARD TRAINING LIMITATIONS

FUTURE CONSIDERATIONS

- DEFINITION OF REQUIREMENTS
- KEEP IT SIMPLE
- WHAT DEGREE OF REALISM?
- EVALUATION/CRITIQUE CAPABILITIES
- MAXIMIZE CNBOARD TRAINING

First, in terms of our goals, we are talking motherhood, but they do, in fact, determine policy. Our primary goal is to achieve operational readiness. The change here is that a few years ago, that came as a matter of fact. We had time at sea to train; we could do on-the-job training and operational readiness was presumed when we sent the ships to sea. In this day and age, that is not true. We have highly specialized operator training requirements and probably most significantly, we need highly trained tacticians, both at the operator level, all the intermediate levels, all the way to Command.

Our second goal is timeliness. Ideally, we would provide trained personnel at the time the ship or weapons system is introduced to the fleet. Because of the developmental problems, namely the fact that we do not define a training system until after we define the operational weapons system, this goal is never completely achieved. However, we must strive in that direction because the difference is that, number one, we do not have an operational ready crew, and number two, the cost for providing training in an intermediate basis, factory training or whatever, can be very extensive.

Our third goal, of course, is that we are cost and training effective and I didn't say cheap - I said cost effective. We will be addressing this somewhat more.

Now, how do we do business? Many people from outside the Washington area believe that this is the way we evolve our budgets. Many people from inside the Washington area believe that's the way we evolve our budgets. In fact, there is a structured process known as the Planning/Programming/Budgeting System, of which we are part. Very briefly, let me point out that the basic objective of this system is that the highest level attempts to determine what is the threat and our national reaction in terms of that threat. Then, passing down through the various departments, including the Navy Department, we put together a Program Objective Memorandum, which becomes a . . . , which is the Navy's financial response to the threat as assessed by Government. Once a year we break off the first year of that and make it into a budget, using a similar review process. Now, my main point here is pointing out that we are now addressing POM-84. Fiscal year 84 is our first window for new devices. Fiscal year 83 hopefully is becoming a budget and it's very difficult to make changes. Fiscal year 82, assuming we have one, is going to be already in concrete.

Now for some background in this regard. At the current level, surface warfare training is investing approximately $70 to $80 million a year in the development of training equipment. We project through the POM years that this will increase rapidly in excess of $100 million. Just to give you some feel for the complexity for any one of the 30 or 40 programs that we have within Surface Warfare Training, the majority of them identify RDT&E dollars for new development of a prototype in the

GFE. OPNBA-7 dollars for a training device follow on. OPNBA-2 or -4 dollars for the GFE for that follow-on. O&MN dollars in about 6 to 10 categories, depending on such things as factory training, spare parts, etc. There are MIL-PERS and MIL-CON dollars. All of these various appropriations must be submitted individually, defended separately, and must come together at the appropriate time in order to create a training system.

Now, what directions are we headed in response to those goals? First, it's already been said - we are concerned with training systems and I won't belabor the point, but we cannot address training equipment separate from a total complete training system. Secondly, we are doing a great deal of what we call "front end analysis." If we're going to be cost effective and training effective, we have no choice. We have gone back to basics. What are the tasks and skills involved in operating the equipment? What knowledge must the decision-maker have? Based on that information, we can establish some realistic training objectives, we can define what media is available to do the training, and we can do some honest technical trade-offs in the best way to provide that media. I might also point out the rapid growth of this area within the surface community means that a great deal of this effort is done by contractor support and there is no reason in the foreseeable future to believe that that will change.

It's been said, but probably the most significant thing about where we're going is that we are going onboard with our training. We are committed to it. It is going to be cost effective and it is going to be training effective. There are, however, some comments that I need to make about onboard training.

It's dangerous. Right now, we have the technology to put good simulation onboard the ships. The danger is that we do not have the instructional technology to use it in a training environment. If we put it there too soon, we run the risk of creating a negative feeling about onboard training and ruining the program for years to come. We must answer some very basic questions. For a passive sonar operator, what measurement do we want in order to know whether he is doing his job right and how he needs to be corrected? For a sonar supervisor, how do we measure his performance when he is dealing concurrently with a . . . towed and helicopter passive sonar system? For our decision-makers, up to and including the Commanding Officer, how do we measure the performance when they are dealing in a multi-threat environment and at the same time attacking an over-the-horizon target? Without these performance measurements, onboard training becomes meaningless, because we do not have a qualified instructional staff to do it all subjectively. We must also determine ways to automate these performance measurements once we know what they are so that they can be gathered

and used later to critique, which is our third problem. How do we make this information available to the individuals and the teams to do effective training? So, we will be going onboard with training; we will be going onboard in a logical, methodical way so that the training capability is concurrent with the hardware capability.

The second point about onboard training is that it will not replace shore training. The requirement for pipeline training for basic training in our schoolhouses always will exist and we are adding equipment to those schoolhouses all the time. Onboard training becomes one piece of, if I may use the term again, system by which we will do complete training. It will not replace pierside, at least in the foreseeable future, because some of the multiple ship/multiple threat environment situations that we need probably will not be duplicated easily on a total onboard environment.

In conclusion, I hope I have projected to you very quickly how complex the current situation is for surface warfare training. In the area of the development agency, we in fact, in the surface community, deal with two development agencies and sometimes more than that. The development agencies in the SYSCOM, who are developing the weapon system or the platform, the development agency being the combination of CNET, NTECH, and the training community who are developing the training system. I have put industry in the middle of this vu-graph on purpose. We must develop ways to deal with this team effort that must include industry. There are rules and requirements for how government and industry deal with one another during certain phases of development, particularly when things are in the competitive stage, and we will, in fact, obey all those rules and regulations. However, the next day, industry must be prepared to be onboard as a full functioning team. The challenge is both for industry to be able to do that and for government to understand and accept the necessity for this dual relationship so that none of us waste any time because we can't afford the time to waste.

Finally, this vu-graph of an FFG-7 class ship and a simulated LAMS-3 helicopter conveys, I hope, the emerging surface Navy which is now happening. We are in the midst of a revolution, not an evolution. Over the course of the next few years, we will see the most modern surface Navy in the world emerge in the home ports of the United States Navy with the best technology in the weapons systems that can exist. And our mutual challenge is that working with whatever tools we are given, including the all-volunteer Navy, we must be able to field a team of people who can use that weapon system, use those ships, to their maximum design potential because one of the policy decisions that was reached long ago is that we depend on quality and not quantity and we must have the equivalent in our people. Thank you very much.

General Meloy

Our next speaker is General David B. Barker, who is the Deputy Chief of Staff for Training, Headquarters, U. S. Marine Corps. He is primarily an artilleryman, has commanded everything from battery up through the regiment, and more recently, before he took his current job, was Commanding General of the Marine Corps base at Camp Lejeune, North Carolina. It is with great pleasure that I introduce Major General David Barker.

General David B. Barker, USMC

Mr. Chairman, General Miley, distinguished guests, one and all - and I mean one and all. If General Meloy thought he had a tough problem because he had to follow good General Otis, just imagine myself - General Otis, as you know, spoke for the Army; General Meloy spoke for the Army; and we in the Marine Corps have the majority of our equipment on the ground side coming from the Army - we're in bed with them in the development. So where does that leave me? Then there's the aviation side of the Marine Corps, and we're inextricably tied to the Navy for aviation. You already have heard from Admiral Hogan. So the question came, what shall we talk about? Well, basically, we decided that rather than give you the same types of statistics and facts that you heard before, we would touch very quickly - and that's why we have less time than the rest - not because we're the least; because we're so well adapted at getting things done, we can do it in less time.

Truly, it gives me a great deal of pleasure to be here this morning, to have the opportunity to express some of the concerns that our Marine Corps has about our training mission. And as many of you know, the greatest portion of our acquisition program is, indeed, an adjunct to another Service, and in those cases, we share not only a common concern but we often have identical and all too frequently Herculean training tasks lying before us. I would like, however, to express some of the concerns as they appear to me from what I feel to be a very special perspective.

Today, as the Deputy Chief of Staff for Training, I am responsible to the Commandant of the Marine Corps for the training of all Marines. And I cannot express my feelings any better than General McArthur did when he pointed out, and I quote, "In no other profession are the penalties for employing untrained personnel so appalling and so irrevocable." In addition to the perspective of my present assignment, I have also been fortunate during my career to command many units, and in that regard, to train many Marines in numerous environments for various missions and under a wide variety of conditions. Let me tell you about the loggerhead turtle at Camp Lejeune. If you can believe it, when the biologists came down to give us their environmental opinion, the biologists very carefully -

initially when they came in on their in-brief, they said that it appeared because the loggerhead turtle comes aboard the Atlantic seaboard in our area, the 14 miles of beach we have at Camp Lejeune, they come aboard between the months of May through September. Therefore, the biologists said they were going to have to close our 14 miles of beach to training during that time. No joke. Well, needless to say, because of the activities that Camp Lejeune had been doing for many years, they decided that we weren't endangering them; as a matter of fact, we had a system whereby we went by each morning, picked up the eggs, moved them up the beach out of the area so that we could practice our amphibious training, replanted them, and got them out to sea when they hatched. Because they have many perils. That's just one of the little problems that we, the trainers, have.

So we do have a lot of problems in training, but that's not the least of them. Much of that training has been to ensure the attainment and the maintenance of those basic combat skills necessary to guarantee the best possible opportunity for their success on the battlefield. To be ever-ready. Like Lighthorse Harry Lee, I believe that a government is a murderer of its citizens which sends them to a field uninformed and untaught. The ability to develop basic combat s'ills still remains paramount. However, there is a new challenge that today faces us and in speaking of it, the "us" is you and I - your companies and our Marine Corps. Our industrial might and the entire Department of Defense. I speak of the challenge of technology. While the rapid growth of technology has done wonderous things for the American way of life, this explosion has become a monumental training challenge - a challenge to those of us who train young men and women to make effective and efficient use of the weapons and the weapons systems of modern technology. Tomorrow our Marine Corps panel discussion will address the particulars of various training environs. The panel will be made up of Marines from five separate and distinct communities, each with its own challenges and goals and each, I feel confident, with a challenge that you can identify as an area of interest and one which you can benefit us all.

I, too, share their goals, but my perspective is somewhat different. For I am forced to weigh daily the demands of ever-increasing needs for ever-decreasing resources and the gap between them is growing. Most of you are as familiar as I am with the resource constraints and therefore I won't go over the litany of cost increases. However, I do want to mention some of the things that we in the Marine Corps are currently doing.

Today, we use training devices and simulation to overcome training deficiency that we have identified but we are unable to overcome through real-world experience. Perhaps the most vivid example of this is the use, which was previously mentioned by General Meloy, of the Multiple Integrated Laser Engagement System, known as MILES. MILES provides our young Marines with

an opportunity to evaluate their tactics and their techniques in a free-play, force-on-force exercise that provides a valid casualty assessment in near real-term time. It has, in fact, created environment in which we can actually improve and then prove the importance of individual tactical measures. Small unit leadership and sound tactical decisions made under pressure situations. We are only beginning to realize the full value of MILES and we're just now getting into it. We expect to expand its use so that more of our Marines can benefit from this valuable system for engagement training.

Today we also use devices and simulations to provide training that cannot economically be conducted on the real thing. In this sense, economic refers to more than just dollars, as you heard from the previous speakers. It also refers to weapon systems that would be worn out or possibly damaged during training evolutions and therefore we want to move toward the area of simulation and devices and other means - war games, as an example. Here the best examples are the flight trainer, driver trainers, and maintenance trouble-shooting simulators that have all proven their worth many times over - and I, too, in the Marine Corps underscore maintenance. The cost savings in fuel alone are significant, but the greatest value is the increased capability inherent in the sophisticated systems. Pilots and vehicle operators can best be tested now under most emergency situations without any danger to the individual or harm to our actual systems. In fact, a lifetime worth of unusual circumstances can be simulated during a few training evolutions in that simulator. Situations that cannot be done in real life, unless their plane happens to catch on fire, and we pray that doesn't happen.

War games, both manual and computer assisted, also provide valuable enhancement to our training mission. Through their use we are able to exercise decision-making processes in both real and accelerated time, and we're able to evaluate staff functioning procedures, planning evolutions, and plan validity. In addition, our war games will soon embrace the small unit leader and offer him the opportunity to test his tactics as he works to learn how to fight with his fire team, his squad, or his platoon, or the company on the modern battle field. These training devices and simulation systems are with us today as a result of your ingenuity - you, ladies and gentlemen, sitting here in the audience. And these training devices have resulted in overcoming many real-world constraints, constraints brought on by the demand of others for military real estate required for training, by the environmental restrictions we spoke to, by inflation, and the high cost of technology. Add to these constraints the very real fact of increased requirements for education because our devices, our weaponry has become so advanced in technology and so complex we need higher education to operate these devices. And a shrinking manpower pool, because we all know that the recent demography studies showed that between 1980 and 1995, there's going to be something on the order of approximately 27 percent

fewer 18 year olds in the marketplace than there were in 1980. It gives us a real dilemma and it increases our dilemma in significant proportions. These constraints and the rapid pace of technology cause us continually to expand our vision and in order to improve our ability to train on the modern battlefield.

There are two areas in which you, the innovator and master of this technological explosion can be of particular assistance to us, the Marine Corps, the user of training equipment, training devices, and training technology. The first area is an identification of today's technology, advanced capabilities, that may be used to overcome current training deficiencies. We have for so long accepted certain axioms of limitation in our training worlds that we seldom question whether or not those limitations should, in fact, exist. In many cases, they should not. However, the technology to overcome these problems should now be terminated. In many cases, we find that the technology is here, but we didn't know about it. At the same time, that technology is something that many of you live and work with on a day-to-day basis. There is an obvious disconnect in the lines of communication that means so much to both our worlds, yours and ours. On the one hand, we have the requirements that we do not fully define to you as clear requirements, or the mere fact that you're unaware of them. The definitions that we understand frequently mean a lot to us but have no meaning to you and it goes over your head. On the other hand, the technological explosion that is a fact of life in your world is changing things at a tremendous pace and that can help us. In an effort to keep up with that pace, current capability is often overlooked for what is just around the corner. We often spend too much time trying to use tomorrow's technology to overcome today's deficiency.

To paraphrase Admiral Gorshoff, best becomes the enemy of good enough. As a means of putting this in proper perspective, I'll use a very recent example. One of our newest weapon systems uses thermal radiation as a means to identify and acquire a target. The question is, of course, on what kind of target can we practice? The answer to the question was solved through the use of technology that has been with us for many years to heat our homes throughout the United States. The materials that are laced with elements to radiate heat from walls and ceilings are very adaptable to be used on target carriages. Their shapes are easily modified to provide whatever thermal signature is desired - very inexpensively, I might also add. This is not to say that there is no room for research, for there certainly is. It has it places. However, it is best directed toward the weapons systems of tomorrow.

This brings me to my second point - the development of an effective strategy for front-end analysis of training requirements in the acquisition arena. You've heard it mentioned

earlier this morning. We in the Marine Corps, with our recent reorganization of training, are scrambling to put ourselves in the front end of the acquisition processes and as you heard before, we in the Marine Corps have not done well in that area. In this scramble, we have identified a real-world difficulty with which we need your help. The acquisition of any new piece of equipment brings with it a myriad of recognized and unrecognized problems; not the least of these is the need for training. Initial training for the operators and the maintainers - follow-on proficiency training for operators and maintaining those systems - training for software modification - development of training devices and maintenance of those devices. The list goes on. This might be best expressed as a challenge from the user to the provider. How much and how early in the development cycle can that information relative to training requirements be identified in sufficient detail to conduct meaningful cost benefit analyses which will permit the design and training of the maintenance programs to coincide with the introduction of those new pieces of equipment? You've heard it before, but we're getting new systems all the time in our inventory and yet we're not ready - we're not yet ready with our devices to train those who have to operate, to train those who have to maintain, and also to make certain that we can get into this new piece of equipment and be up on the . . . as soon as possible so that we'll have that readiness when the gong goes. You just don't step into that new aircraft and all of a sudden become an expert, or that new tank and become an expert. It takes time.

We have a fine plan today. The Integrated Logistics Support Plan, we call it - the ILSP. It's designed to identify at the earliest possible stages our training requirements. However, as I stand here this morning, I'm not convinced that we in the Marine Corps are making the best possible use of our ILS system. As you become involved in the development of new equipment, as a principle or as an adjunct, I beseech you to think training in the fullest sense and in the fullest range, right from the start. Recognize the fact that the design of equipment may well be dictated by the maintenance and operator training that we can afford or are able to conduct within our services. Recognize the fact that the level of repair may well be dictated by similar factors. Recognize that sophisticated weapons systems often require sophisticated training systems and that those training systems may require long lead time for development, as well as their own operator and maintenance programs.

To the Marine Corps, training equipment is not just nice to have. It's an integral part of our Marine Corps. We can only be ready if we can train properly. It must be effective and it must be efficient and it must be available early on. We are trying very hard to overcome today's deficiencies and to prepare for tomorrow.

So in sum, I beseech you, I ask you to give us your help in the form of hardware and ideas from which we can draw so that we can jointly resolve our training problems and move forward and maintain a strong, viable armed force. Thank you.

General Meloy

Ladies and gentlemen, our final speaker before we break for lunch this morning will be Major General Dick Burpee, who is the Director of Operations, Headquarters U. S. Air Force, in Washington. Another Commander, also with extensive command background, having commanded both at wing and at air division level. He is also the ex-Director of Training of SAC at Offett Air Force Base in Nebraska. He has been the Director of Operations at Headquarters, U.S. Air Force since July of 1981. General Burpee.

General Richard Burpee, USAF

I'd like to just talk for a second about the evolution of training that we've had in the Air Force, not to bore you with a lot of details, but to give you a little feel for how we got into simulation and why we think it's so good.

First of all, as Admiral Hogan talked about earlier, we got into the instrument procedure trainer and it went quite well and we got a lot of pay-off and a lot of feedback, a lot of good training. Up through Korea, we had aircraft in inventory that were very forgiving - you could do all kinds of things with them, you could get out of stalls, they could spin, they could do everything. They were very forgiving and so we really didn't have to get into a really sophisticated type of training to enhance our capability to fly the airplane. But when we got into the Century series business, beginning with the F-100, being a single-seat aircraft and being very high-performance, unforgiving in many ways, we realized we had to have a better learning pay-off and turned to the simulation business.

And so we did that. And it whet our appetite, I guess, because we got into employment phases later on and when we found we had visual systems and six-degree motion, these kinds of things, we turned to more sophisticated systems to see if we could employ the simulator, rather than just learn procedures and instrument techniques, etc.

Two things happened to us in flying training in the 70s. First of all, we had a terrible flying-hour draw-down in the energy crisis of 1973 with the Arab embargo of the oil. It had a big impact on us and it made us turn even more to simulation. I'm showing here an average F-4 fighter pilot and I'll start back at a point in 1972, when he was running a little bit over 20 hours a month. After the embargo in 1974, he dropped down to a little over 13 hours. At the same time, his airplane, his

F-4 - back in 72 he was flying the D model and the C model, and we've updated and modified the E model, our latest version, which hardly resembles the first two versions of the aircraft, so we have a more sophisticated aircraft now even in the F-4 system, with a decreased number of flying hours for our pilots. Certainly not a very good situation.

When we look at flying hours, what we were flying after the embargo in 1974, we were running about 4 million hours a year and that has decreased now to about 3.2 million. As far as the fuel is concerned, we've gone from 115 million barrels a year down to 88 million. Through energy saving techniques and all kinds of things which we've worked at very hard, we have been able to bring that down a little bit. But when we threw the cost figures on the board, it really sky-rockets. In 1974, our flying hour costs were about $1 billion. In 1981, our last year's budget was $4.5 billion for fuel dollars alone. If you want to take a look at 1978 where the big jump starts, and take weapon systems, for example, the B-52 cost $4,000 an hour in 1978 and this last last year it cost something over $6,000 to operate. Obviously, we have to try to get more out of our flying time that we have. That's the point I'm trying to make in this whole series. Simulation is going to help it.

We could take the word challenge up there if we wanted to and substitute the word threat and it would mean the same thing. The threat has increased. It certainly hasn't decreased with all the flying hour draw-downs. I'm showing a picture of a MIG-23 here, but there are a lot more advanced generation fighters coming along through the Soviet Union. I should just tell you that they produce a new fighter about every 7 hours for about 1300 or 1400 a year, and we produce about 300 to 400 new aircraft a year. So the threat is continuing to increase.

What's the answer to all this? We say in the Air Force that we want to take a look at the total integrated approach to learning. The total system - academic, simulation, and productive flying hour program. I'll touch each one of these.

First, academic. Probably one of the great strides we've made in the last few years is in the academic area. We have gone from a structured training environment down to a more individualistic training environment. That doesn't mean that there's not a place for classroom activity. There certainly is. There are some tasks and some events that you can only train through the classroom environment. We've had self-paced study programs, program learning, this kind of thing, and that has to stay with us.

The second part of our total integrated learning process is simulation. The key to the whole thing, and I think that's why we're all here, is we're trying to get the optimum learning

transfer that we can get from our simulation systems. What we're trying to do is not decrease the number of flying hours we have, because they're too precious, as you can see, but when the guy gets in the aircraft he gets the maximum productivity out of that flying hour and I think he can gain that through simulation.

High pay-off tasks - there are some tasks that you can only do in a simulator. For example, in emergency procedures, you can increase the emergencies on a pilot or crew - practice bail-outs, flame-out engines, lights light up, bells ring and he gets out of the simulator and he can be debriefed on what he did right or wrong - you can only do that in a simulator. Electronic warfare environment. If a B-52 that's flying our low level routes turned on his anti-jam capability, it would put out all the television sets along his route of flight and we couldn't live with that. But we can do that in a simulator. At any time we're in the simulator we can drop bombs, fire guns, shoot rockets, or whatever, and we can't always do that because of the restricted ranges and this type of thing, the constraints that we have put on us by our normal training ranges around the country.

Some of the things that we do best in the simulator, as we've already talked about, are the procedure tasks. We can do those. It certainly doesn't make sense to waste a lot of time learning procedures with a flying hour when you can certainly do it in a simulator. And you can learn all kinds of systems operations. I recall one good example out at Castle. It used to be a few years ago when we taught a crew how to run the air refueling panel on a KC-135, which is not real complicated but if you have trapped fuel and this sort of thing you can induce all kinds of scenarios where he has to move the fuel around the aircraft. The primary worry, of course, is that he might get his center of gravity out of balance and lose control of the aircraft. They used to teach that system and say, "Don't pay any attention up in academics - when you get down to the flight line we'll have time and while we're doing a navigation leg we'll learn this refueling systems panel." Well, what really happened was that the man was trying to learn two things at once because when he was turning knobs and switches he was usually in the traffic pattern and he was trying to fly the aircraft in the traffic pattern and at the same time trying to figure out the fuel management system and the instructor is questioning him on what to do and all kinds of things. So he had split learning transfer problems. We recognized that finally and when we got into the instructional system development phase, we made the man be completely proficient in procedures trainers, in the sound-on-slide programs. He had to be completely proficient before he went to the flight line. We got great dividends out of it. His flying hour productivity increased, he learned more about flying traffic patterns, and so it was a great boost. So you can best learn systems operations in simulators and in the academic environment.

I want to talk just for a minute about stress, and I'd like to put to bed the problem that we hear about all the time about can you induce stress in a simulator. My answer is no. You can induce a certain kind of stress which in most cases is fear of failing the simulator ride or fear of not doing well in the simulator, what the consequences might be if you don't know your procedures. But as far as inducing stress with regard to saving the old body, you simply can't do that. I think what we ought to do in the simulator business is forget about trying to do it. We have a lot of systems - we have motions systems, visual systems, all of those are attempts to try to induce some kind of an aircraft stress. You just simply can't do that. If you're flying an F-111 simulator through the mountains on 200-foot train following setting in a simulator, you may get one or two sweat rings under the armpits, but if you hit the mountain, you get out of the thing and you call the guy on the console and say, "Hey, jack me up 200 feet and let me get started again." I'll guarantee you that doesn't happen when you're flying the airplane. I'm reminded of the story about the guy in Korea, the flight lead and his number two man got a little separated and the lead was off and he had three MIGs on his tail. He called number two and said, "Hey, get down here, I've got three MIGs on my rear end." Two didn't acknowledge or say anything and pretty soon a real panic call came across and he said, "Hey, get down here - I've really got three MIGs on my tail." With that, two punched the button and he said, "You've got the Distinguished Flying Cross, now let's see you do some distinguished flying." That's the kind of stress that you can't induce in a simulator and I don't think you should try to do it. That's my message.

To complement and round out, first of all the academic instruction and then the simulator process, the flying training is where we put the whole thing together and try to bring it into a realistic training environment. We have an operation called Red Flag, out in Las Vegas, and our Army, Navy, Marine counterparts all use the same range and we get a lot of great training out of it. We have a couple of aggressor squadrons out there in the F-5, which flies Soviet tactics to try to simulate the tactics that the Soviets use - and the fact is, they do use those tactics. We present our crews with as realistic a training environment as they can probably get anywhere in the world. It's very fast, it's very intense, and a lot of great training comes from that program. Also out there, one of the great things we do - and this is a part of your task - we have the ACMI, the Air Combat Maneuvering Instrumentation system where we watch in three dimensions in the debriefing; when we get the crews back, we can show them where they either lost the air battle or gained advantage of the air battle or maneuvered the aircraft in the right or wrong position, and it's a great training device that we can use to complement the realistic training environment. We also have some television scoring when we make live drops, etc.,

out there that really helps. It's a realistic training environment. And that's the pay-off. That's where the flying hours that we use at the terrible cost I've indicated, really pay off and pay great dividends.

I think you've heard everybody talk about the simulation this morning and all the things that we have to do. I just want to tell you that we look at it in the Air Force as part of an integrated approach. You've got to have the synergistic effect of academic, simulation, and realistic training, the actual flying hour. It has to be put together as part of a whole. Years ago, we tried this process in the Air Training Command where we would trade off - every four hours in the simulator would buy one hour of flying time. We've tried that and it doesn't work. It's been a failure. So we can't say just exactly what that trade-off is. What we can say is that when we did put that guy in the simulator, he has become a lot more effective, more proficient, and his learning curve is a lot higher once he hit the airplane. So we have had some high pay-offs. Our appetites have been whetted. We do see real pay-offs in the simulation world and we want to continue along that vein.

We need to train for wartime tasks. As I mentioned earlier, there are some things you just simply cannot do in the peacetime environment to train for wartime tasks, like the electronic warfare systems, for example. So that's an area that has to be worked and worked very hard.

Our concerns, like everyone else that you've heard up here this morning, I want to elaborate on high costs. The B-52 weapon systems trainer right now is running at about $44 million each. I don't know what the airplane costs - $4 or $5 or $6 million, something like that. But it's a terrible cost. The B-1, the estimate on the simulator is $75 million. When I was in the Pentagon ten years ago, that was the price of the B-1. Late deliveries - we're constantly plagued with late deliveries. We have 500 plus A-10s out flying around the world right now and we still haven't got a simulator. We've got a simulator that's just about here, one that has been manufactured, but the wings still don't have a simulator. So we run two to three years behind in getting these systems.

Technical deficiencies - we probably share the burden here along with you. I think of the F-111 visual system, for example. We probably wrote the specifications very poorly and we probably pushed the state-of-the-art a little bit too far. We also probably expected more and once we started to see what this thing could do, expected more than we should have expected from the system. It has not worked out very well and it's of marginal utility, and in the tactical forces we don't even use it.

I'm going to conclude by just saying this, that all the things we want to do and I hope that the only reason that you're

here is to enhance the total combat capability of our forces. And that includes all the Services. I know that the Strategic Air Command has a phrase, "Peace is Our Profession Through Deterence" and that's absolutely true. But one of the things that all of us have to remember in our business is that war is our business and anything we can do to optimize our training, to enhance our combat capability we ought to be doing it. Thank you.

Mr. Merl

It's been a long morning, a very interesting set of presentations and I'm sure you enjoyed them as much as I did.

With respect to questions and answers, we've decided with the morning having gone as long as it did that you're to save those for the panel sessions that are all scheduled for tomorrow. We'll have most of the speakers back at that point. So at this point, we're going to break for lunch and will reconvene at 2 o'clock.

SESSION III

MEETING USER NEEDS

Colonel Campbell

I think we're just about in reasonable array and as your Session Chairman for this afternoon, I'd like to immediately announce a change in the agenda. We have a real unexpected pleasure this afternoon. It's the kind of thing that when you're in one of these conferences and you can look down the road to Tampa and see some wonderful expertise and some driving force behind training devices and simulations over the past three or four years in the Army, you almost feel compelled to say, would you please come up here and say some words to us because you've been there and now you're back out in the user community and I'm talking about General Don Starry, who is now the United States Army Maintenance Command Commander. You all know that General Starry has been a user and a trainer through his whole career in the Army, mostly in armor units, commanding everything from platoons through a Corps in Germany. Back in the States, he was the Commander of the Armored Center and School at Fort Knox and later and most recently before his current assignment, as the Training and Doctrine Command Commander, Fort Monroe, Virginia. It was in this capacity that he began to really push for training devices and simulation in that era, and a lot of the initiatives that we're developing today and

the things that we're seeing happen were because they were instituted on his watch. Sir, without belaboring a whole lot, we're delighted to have you and I'd like to have the crowd join me in welcoming you. General Don Starry.

General Donald Starry

Thanks, Don. Don asked me to come over and say something impromptu following Dean Tice. Since Dean Tice isn't here, he asked me to come early and say something two times impromptu. Those of you who know me know that I like not to talk in public unless I throw out some kind of a challenge and so in thinking about this, I decided to present you with all the challenges that we were not able to resolve on my watch and perhaps some others that we can see in the days ahead as we try to figure out how to use all these wonderful toys that I've seen displayed out here in the training business.

If I appear to be critical, please bear in mind that I'm criticizing us as a corporate body, because, as Don said, a lot of this happened on my watch and so in some degree at least, I'm criticizing my own inability to cope with these problems. But they are the challenges that remain with us and those that I see as we look ahead in this business.

Let me list four trends or tendencies, if you want to call them that, that I see in the business that we all are involved in, and then from that draw some sort of guidelines or rules that we need to be able to follow or to start following if we're going to make simulations useful to us in today's and tomorrow's world.

First of all, there is the tendency to build things that are too costly in order to do something that can be done good enough, as the Russians use the phrase, by some other means. Let me give you an example of that. Somebody in this room, I am sure, works for a company who built a tank driver simulator down at Fort Knox. I went down to see it and it was built to replace some simple little cabs that are about the size of a large packing box, for which we paid originally about $12,000 each, which we used to train the soldiers in tank driving. It isn't a simulator. All it is is a driver's compartment familiarization device and it makes some noises and you can put some troubles in the back end of it that will cause the driver to react. It's kind of a familiarization and practice thing for the driver. They were cheap. At one time we had almost 60 of them in operation at Fort Knox, and we've been using them for nearly 18 years now. So when I looked at this marvelous modern marvel that they had built in response to a requirement to build a driver simulator, it was little better, cab by cab, than the little simulators that we were using for driver compartment familiarization, yet the cost of it was about $2.5 million, to which I just have to say, thanks a lot for your interest, but that doesn't do the job. Now, whether that's our fault in the

military for not stating the requirements correctly or some failure to communicate with the contractor what we really wanted, I don't really know. But we can't afford to spend a lot of money for something that is complicated and expensive and requires air conditioning, and so on, if it can't do a whole lot more for us than we can do with something that's very simple that we set out in a shed and as long as you keep it out of the rain, it works pretty well most of the time.

Secondly, there's a tendency not to understand the volume problem in training. This is particularly true of training in the United States Army. Enthusiasts of all kinds, a lot of them wearing green suits, go to Europe and look at those marvelous simulation devices that the British have bought, for example, for tank gunnery and tank driving and so on. They tend to go to Germany and look at what Honeywell has done for the German gunnery simulator, and they come home all enthused and say that we need to buy some of those. Wait a minute - because if you take the number of soldiers that the Germans train or that the British train each year in those skills and multiply that by a factor of somewhere between 6 and 12, you get the United States Army training requirements. And so you can't buy a $50 million simulator if it will only train one man at a time, because we need to train not one but perhaps six or a dozen men. And so, we ourselves tend not to understand the volume problem and we tend to look at those other machines and say it's great. That's right, it is. But unless you can afford to pay the price for the full suit, if you will, the numbers of systems you need to train the numbers of soldiers that we have to put through initial entry training, if that in fact is the purpose of the device, it becomes quite a different problem, particularly from an investment standpoint as well as from an operations and maintenance standpoint.

We have a tendency not to be able to justify or identify clearly enough to ourselves or to the Congress from whom we solicit the monies for these things that I call the transfer function. How much of this training is transferable to the real item of equipment? If you're buying it to save money in operations and maintenance, how many missiles a year do we not have to fire or how many rounds a year do we not have to fire in service practice because we spent X dollars for this simulator? If you're trying to save investment costs, as simulators become more expensive we are clearly in a mode where we have to look seriously at whether or not we need to reduce the size of the vehicle fleet or the aircraft fleet and use some of the monies that we would have used to buy major end items of equipment to buy the simulators. Most of us would like not to do that, but when you get a simulator that costs as much as the major item itself, then you have to look at it in that light. When simulators begin to cost that much, unless you can begin to describe in a very quantitative way what it is that you can

transfer from that simulation system to the real system, how much training is reduced, how much maintenance costs or operating costs or investment costs are reduced as a result of the purchase of the simulator, then you're not going to be able to justify the cost of the simulator.

There is a tendency, finally, to ignore or to set aside the context in which the simulation device has to operate. It isn't just a matter, for example, of building a gunnery trainer for a tank gunner or a driver trainer for a tank driver or a missile crewman trainer for the gunner in the front seat of a helicopter. It's a question of putting whatever that individual training experience is supposed to be, it's a question of putting that together in the context of the other things that have to go on either on the crew in which that soldier is a member or on the systems of which his little crew is a part. And so more and more, we need to look at simulation devices which will simulate the interaction, particularly of small units, because that's where we learn fundamentals. And that's where we're weakest, as a matter of fact, in teaching fundamentals to our soldiers in the field today.

From those four things -- a tendency to build things that are too costly, to do something that can be done with something that's a lot cheaper, a tendency not to understand the volume problem, particularly in the case of Army training, the tendency not to be able to clearly identify the transfer function, and the tendency to ignore the battlefield context in which the individual must perform as a member of a team, crew, squad, section, platoon, and so on, let me reduce those to about four or five imperatives that it seems to me we need to put up at the top of our list of things to consider before we decide whether or not to try to build a simulator.

First, what is the purpose of the simulator? Why do you want to buy it? Do you want to buy it to save O&M? Do you want to buy it to save investment? Do you want to buy it to save time? Do you want to buy it to improve training? Or all of the above? And I would submit to you that not every simulator that is built can solve all those problems and so there has to be some front-end appraisal on the part of the guy who asks for the thing to be simulated of what he wants to do with it in the end. For example, simulators to maintain the proficiency of crews and individuals in the field establishment need not necessarily be employed in the training establishment. Therefore, you might be able to buy fewer of them or you might be able to put them in little centers, as the Germans have done so effectively with their tank training and so have the British. But you need to decide what the purpose of the simulator is in terms of the total system - investment, operations, and maintenance time, training time, and training output, that is the quality of the trained soldier.

Secondly, how efficient does it need to be? This is the transfer function. And in the transfer function, if we could describe the curve for a transfer function, I can guarantee you that it will have an inflection point some place along that curve beyond which it will tell you that it is no longer efficient to buy more of those or to make it just a little bit better for every given unit of cost. And so, at the point where you reach diminishing returns in the transfer function equation, it's time to cut off the technology that you apply to making it just that much better in an endeavor to buy more of them at less cost which are perhaps not quite as effective as they would be if you simply added that last little increment of efficiency.

Third, what will you buy or not buy, if anything, in order to buy the simulator? I alluded to this in the cost problem a while ago. I don't think I need to say any more about it. As the cost of simulation approaches the cost of the real item, you then have to decide how many fewer of the real things you're going to buy in order to pay for the simulator. Most of us would like not to do that. Let me just say one other thing about it. The rising cost of simulation, and therefore the need to trade off simulators for real items tells us that what we should be trying to do is take the end item itself and apply the simulation system to it in such a way that we don't build a separate simulator, but we simply take out some hoses, nozzles, and other gadgets and fasten them on to the eye pieces or the listening pieces or whatever of the real machine and simulate for the soldier inside the machine what's going on on the outside in such a way that you can then buy more of the real machines if you can figure out a simple and relatively inexpensive simulation device to hook up to the machine in the first place.

Fourth, how can you get it in the field quickly enough to be useful and quickly enough to take advantage of the technology and quickly enough to avoid being overtaken by events? No better example of that exists, I think, than those enormous map boards that we built for the aircraft simulators at Fort Rucker. I use that as an example because it is an example of two things: how quickly something can be done if you really want to do it. I first saw those boards in about 1974 or 1975 in Binghampton. They were black and white and they weren't all put together yet. Four or five years later we had them erected down at Fort Rucker and we were running the aircraft simulators on them. Marvelous in terms of the normal developments. Within a year or two after they were installed, along comes computer-generated imagery and the boards are now obsolete. I'm not saying that we should have held up the production of the boards in order to wait for computer-generated imagery to come along, but it just tells you that unless you can field the generation of simulators that uses the technology that is extant, you will quickly be overtaken by the next addition of technology that comes along, which was the case with the boards.

For example, something over 50 percent of the total power consumption resources of that one Army fort are tolled off to support that simulator building because of the air conditioning and the lights that have to light those boards. Now we're going to tear all that down just after we got through building it. So technology moves on. Get it quickly in useful form into the field.

And the last "rule" I'd like to give you is if we don't figure out how to train the whole team, the simulation business is never going to grow much beyond just training individuals to do individual things, when really the individual, in the case of ground forces but in air forces as well, is only as effective as he is able to operate effectively as a member of a team, whether it's a two-man team or a four-man team or a six-man team or whatever, it doesn't make any difference. Somehow, in some part of the simulation world we really have to learn how to simulate the other things, that is, the battlefield context in which that soldier, sailor, or airman or marine has to perform his battle functions.

Now having said all those things, and at some risk, I would like to offer you the chance to ask questions about what I've said or anything else if you'd like. Rebuttals, I suppose, are appropriate if you feel the urge to rebut anything I've said. You can blame it on me if you want to, because clearly, some of you whom I know rather well and I have been in the transfer function business since 1973 and we're still not much further along than we were then, which just says that some of these things we're not very smart about.

Now that I've had a chance at you, who'd like to throw a few rocks at the impromptu - Jim, I knew you would.

Question

Sir, with regard to one of your imperatives, we know that the delay of introducing a simulator so that it nearly coincides with the introduction of the main end item, is the function of freezing the design of the main item. Do you have any ideas about how far the Army would be willing to go to back off from that 100 percent identical simulation in order to permit an earlier design freeze on the simulator in order to speed up the introduction of the simulator?

General Starry

Jim, I don't know that there's any single answer to that. I think it's clear that it will vary a lot from system to system. In a general sense, once we decided to try to do away with OT-3 and foreshorten the development cycle by making some of the decisions at least that we were going to make as a result of OT-3 out of the DTOT-2 process, we aggravated the problem that you

just cited. If you accept the fact that OTDT-1 are simply fixture experiments to see if the pressures and the temperatures and the working parts are about right, it's a long way from there to a fielded product, so the tendency is to stretch out the time between OT-1 and OT-2 because we know we're not going to have an OT-3 to fix the things we found wrong in OT-2. That's both good and bad. It tells us that we have more time to do the things you cite, but it also stretches out the development process which is what we were trying to shorten by doing away with OT-3. We have the same difficulty with regard to the training materials and the logistics system and a whole bunch of things that fall into the same category as the simulator system. The great tendency is for the developer to promise the user just a little bit more if the user will wait just a little bit longer and give the developer just a little bit more money. All too frequently that turns out to be much longer and a lot more money. So at some point, someone with enough courage just has to say that's good enough. Let's print that one or build that one or publish that one and if you decide first of all what you want the simulator to be able to do and if you could describe that to yourself early enough in the development cycle, it seems to me that you could build the simulator sort of in parallel with the hardware itself, and at some point you could cut them both off - maybe not at the same time - realizing that you may have to make some minor adjustments to the simulator just as you're making to the major item itself. As you proceed through that OT-2 and beyond the OT-2 process, there are clearly going to be some things that need to be fixed after the OT-2 process, so some provision has to be made for that to be done in the simulator as well as in the major item. Sometimes that's probably not possible. The Air Force is still looking for the simulator for the F-16, clearly because it was not possible to predict early enough in advance how that thing was going to turn out and so they didn't build the simulator, or it may be that they wanted to build more airplanes and they spent money for that instead of for the simulator. However that is, they don't have a simulator and they're suffering from it.

I didn't answer your question directly, but I don't think there is a direct answer. I'd almost take that system by system. But the first question inevitably is what do you want to simulate? What is it profitable to simulate? How efficient does it need to be? What are you going to buy? Do you want some of those simple little cabs that I talked about or do you want a full-up driver simulator with 6 degrees of freedom, which means you're into the airplane simulation business. Can you get it in the field fast enough if you ask for the sophisticated as opposed to the simple simulator, and how does that relate to the battlefield context in which the thing has to operate?

(The next question is unintelligible)

General Starry

Here again it depends on the system. I'm not sure that I would agree with you as a generalization with regard to the cycle you just described. In fact, we do have DT-1, certainly. Sometimes it's difficult to have an OT-1 because the DT-1 tends to be a fixture experiment based on pressures, temperatures, and so on, and so there isn't anything to really test from the OT standpoint. So the OT tends to be sort of downplayed in the OTDT-1 part of the cycle. But we have to have them, nonetheless. The fact that they don't look like operating weapons or operating systems many times tends to discourage the user and so the user tends to say, we don't really have an OT-1 here, which I think is what you were saying. I've had enough experience in this, I think, to say that I don't really agree with that. OT-3, on the other hand, in times gone by one of the reasons we eliminated it was that OT-3 tended to be simply a confirmatory test and it was more OT than DT, so we wanted to drop the DT out of it. It was OT because what we wanted to see was whether or not the developer had fixed the things that the user and the developer both found wrong in OT-2. And so OTDT-2 became the crunch point in the development cycle and the more we looked at it, the more we realized that if you pass the system through OT-2 DT-2, you had in fact bought the system. Therefore, why don't we just eliminate or downplay the part that the OT-3 was supposed to play in that cycle and settle on a stronger and better coordinated OT-2. That's what drove us to eliminating that part or making that change in the development cycle. You could charge - and I think I would have to agree with you - that we haven't done as well at coordinating and closing the loop in OT-2 as we might have, although I would say in the case of the tank development program that that thing turned out rather well, in spite of the fact that a lot of people are still misrepresenting the truth by using the early testing experiments to describe equipment that we're operating today which is in no way like the early equipment. We did make that work very well and we're making it work with some other systems in equally good fashion. So I'm kind of encouraged by the way that has developed. I would also say just in passing, with regard to your initial comment that it takes 20 years to make a cycle work, if we can't get that cycle down to something within 10 years, we're going to be out of business. The best example I know of that is the radio. We still have the ANVRC-12 series radio. It's 1950 technology, it's 1960 equipment. It will be in the force at the rate we're going for 50 years. Last year it had taken us 19 years to buy 56 percent of our acquisition objective. This year we're down to 46 percent at 20 years, and that's a technology that turns over every 3-1/2 years. In my view, doing business in that fashion is unconscionable, and we're to blame as much as anybody else. The Russians are turning rings inside of us in the development cycle. We sit here congratulating ourselves happily that we are ahead of them technically. We may be ahead

of them in some laboratory, but they're ahead of us technically in the field because they can field their "old" or obsolescent technology much faster than we can field our little-bit-better technology. Unless we can figure out how to overcome that problem, we are never going to get much better than we are now in simulators, weapon systems, or anything else.

Question

I'd just like to reinforce one of the points that you made in your presentation, General - that of student loading or how much time he should have in either a pipeline or refresher situation, including the number of sites of such systems. Is anything being done in the initial phases of the planning of such systems to identify those issues as a part of the front end analysis?

General Starry

The answer is yes, we're trying to do something about that, but I have to admit to you that we're not very good at it, for two reasons - one because we don't know how to describe the transfer function qualitatively or quantitatively. When you're dealing with simulators that cost as much as they do today, no subjective judgement about whether or not one is necessary is going to be sufficient. You have to be able to put that in some kind of an equation that has an objective function and reduce it to something that can be explained in numbers in terms of the dollars you're going to spend and the efficiency or effectiveness that you intend to get out of it. We have a large group of people who are in the training effectiveness evaluation business and they're smart guys. I'm not denigrating what they do at all. I'm just telling you that the state of that art is not very well advanced. We don't know how to do it very well, and therefore, we don't know how to do it at the front end. It would help a lot, on the other hand, if we, the users, could simply describe for the developer as well as for the simulation developer what it is we want to simulate. I remember when I was at Knox, we had to have a full crew tank simulator. Someone had been to England and looked at that . . . systems that they've got over there and we could get one for only $12 million. So we were down here negotiating with one of Don Campbell's predecessors for a $12 million simulator. They came in one day and said, "By the way, it's going to cost a little more than $12 million......it's going to cost $26 million." I said they would be back within six months telling me that they wanted $50 million. They said $26 million would cover it and get me some spares. Five months later, they came back and said I had missed it a little bit - it wasn't $50 million. When they got to $65 million I told them to scrub the program. So I'm to blame for not having a full-up tank crew simulator. Maybe we didn't say clearly enough what we wanted to simulate at the beginning, but the unending greed of the developer just drove me away from it.

I decided to let the aviation community, which was then run by Jimmy Smith, pay the bill for that and then the tankers would come along and take advantage of it, which we now can do.

(The next question is unintelligible)

General Starry

One of the reasons the Abrams tank has come along as well as it has, even though some of us would have preferred to have it come along more quickly, is that the day they got the plywood and the little skill saws up at Detroit, there were sergeants from Fort Knox saying, "don't make it like that - it won't work." We hadn't a single bolt when that thing started and we had sergeants there from the day it began. We still have some things on that tank, from the standpoint of the way the crew has to operate, that need fixing. That tells you how tough that is to do. But I would contend that if you don't do it that way, you're going to have a whole lot more things to fix in the end and so it's going to take longer than it would if you do it that way. To me, that's the single biggest thing we can do to help ourselves out. The other thing we can do is reduce somehow the numbers of layers of people in the system, Army, OSD, OMB, and the Congress, who have the authority to say no or change the monies for the development of the system who are not responsible for the outcome of what they say.

I guess that exhausts it, Don. Thanks very much for letting me come and talk with you.

Mr. Merl

Thank you, General Starry. As usual, it was a very interesting and informative discussion.

Jim Gardner has asked for a couple of minutes to say a few words about next year's conference, since this one has just started.

Dr. James Gardner

You're probably wondering why we're talking about next year's conference when this one has just started. Actually, this is your conference and you have a part in the planning of this conference, so I'd like to alert you to some of the topics that are occurring and solicit your inputs on how we might improve, because we want to improve this conference from year to year. So as you attend the various sessions, attend them with a critical eye and let me know what you'd like to see next year changed or improved, or what you like this year that you'd like to see repeated. I'm the conference chairman for next year and I'll tell you some of the names of others that will be working with me on this conference. The National Security Industrial Association will sponsor next year's conference and the

Navy will be the coordinating Service. Captain Jack McHugh will be the Executive Conference Chairman and Mr. Tom McNaney will be Chairman of the Interservice Steering Committee. The conference will be held on November 16 through 18 at the Hyatt Hotel, which is about 15 minutes west of here at the I-4 turn-off to Disneyworld.

You have in your conference registration package a brochure which describes the next year's conference and outlines a preliminary call for papers. If you're interested in submitting an abstract for consideration for next year's conference, please contact Mr. Ralph Davis of Cubic Defense Systems, the Program Chairman, whose address is listed in this brochure. If you're interested in the exhibits, contact Mr. Marty Morganlander of Gould Simulation Systems Division, the Exhibits Chairman.

A table has been provided in the back in the registration area and you can obtain further information about next year's conference at that location.

The conference will again emphasize the user and we would appreciate receiving any suggestions you might offer to encourage more and better user participation. A special note of interest is the opening of Disney's Experimental Prototype Community of Tomorrow on October 1st of next year here in Orlando. We're looking forward to seeing you again next year at the fourth annual conference, and would very much welcome your suggestions for improving the conference and adding to its content. Thank you.

Mr. Merl

Our next speaker has a rather interesting background - a Ph.D. in Geophysics from the University of California in 1956, is currently Deputy Director for Research at the Defense Advanced Research Project Agency, DARPA. Most of his professional experience since 1949 has been devoted to the development of methods for detecting nuclear explosions at great distance. Ladies and gentlemen, Dr. Carl F. Romney.

Dr. Carl F. Romney

Thank you very much. It's a real honor to be here to represent the Office of the Under Secretary of Defense for Research and Engineering, and also, of course, my own Agency, which is part of that organization, DARPA. We believe that the importance of training technology is related in a very direct way to the nature of the military world of today and as we see the future. We note the very large asymmetries between the U.S. and the U.S.S.R., the heavy and sustained investment in equipment that's been going on in the U.S.S.R. for some time. They have substantially greater military manpower available.

When we look at the future in the U.S., the future of the U.S. force structure, we see some growth in investment, but it looks like it would be very difficult to quantitatively match all of the developments of the U.S.S.R. and, of course, we foresee at least for some time relatively constant manpower and a struggle to maintain the quality of the manpower. The conclusion we come to is that there is a crucial need to offset these quantitative advantages of the Soviet Union with technological superiority. This drives all of our R&D efforts within the Defense Department and I regret to say that training technology is a very small part of that. Sometimes those of us from other disciplines - and I certainly am not an expert in training - tend to overlook the importance. But we do recognize that the technological superiority is effective only if the equipment is operated and maintained close to the design limits. It does us no good to have a very swift widget if the widget doesn't work at the critical times.

Hence, there is within U.S. DR&E a training technology program, a major thrust, that will amount to around $250 million in 1982. Today I plan to look at a rather narrow aspect of the training problem and that is the need for practice and I'm going to look at it particularly from the cost standpoint.

Now I'll tell you a little bit about what DARPA is doing to address these problems. I think you'll see that the members of DARPA that are responsible for our very small training program have been listening to General Starry and people like him, because you'll see we're addressing some of the critical needs that he mentioned.

The need for practice is very well understood, but to be effective, it must be regular and often daily to develop and retain critical skills. We believe also that the most significant training is relevant to actual combat and, of course, this directly impacts the survivability of troops, their effectiveness against the enemy, and our own ability to train replacements quickly in the event of losses.

Of course, we realize that training with real equipment is very costly and that's, of course, what this meeting is primarily all about. This slide shows estimates we obtained from the U.S. Army of the cost of live rounds of tank munitions projected out to 1985-86 timeframe. You can see the cost of firing a single round is estimated to climb very rapidly toward almost $2,000 a shot. That means, of co rse, that in training, live firings will necessarily be reduced to token firings. If you look at the cumulative costs, multiply these costs across a number of different kinds of weapon systems, you can see that we will be burning up a half-billion dollars a year by 1985 just for ammunition.

And so, we turn, obviously, to simulators. Simulators of the kind that you can see in the exhibit hall are very

THE SUCCESSFUL EMPLOYMENT OF SOPHISTICATED WEAPONS IN COMBAT REQUIRES:

- *REGULAR AND INTENSIVE PRACTICE*
- *COMBAT RELEVANT SKILLS*

PROBLEMS OF PRACTICING WITH REAL EQUIPMENT:

- *HIGH (ESCALATING) COST*
- *INABILITY TO PRACTICE MANY CRITICAL COMBAT SKILLS*

sophisticated. They are capable of very realistic training and some of them in rather complex combat skills. This trend toward sophistication, of course, comes with a price tag. If you look at skills that need regular training, you can make an estimate of the capital investment that would be necessary by simply multiplying the number of practice hours per day by the number of learners and divide by device availability times the cost of a simulator. Here's an example of a couple of approaches to training and four skills that might require one or two hours a day training and a very modest number of pilots. You can see that the investment would be staggering. Consequently, we feel that there is some risk that we would buy too few devices to do an effective training job. Therefore, we must look at technologies that produce skills at an affordable cost.

Within ARPA, we have a very small program. It's very difficult to do something that really makes an impact when you measure our roughly $10 million against the major efforts of the military services. So we've undertaken research that's based on the principle that many long and complex procedures and operations can be broken into smaller skill segments. These can be practiced, we believe, easily and flexibly, economically. The approach we've taken is based on systems using microcomputers and new display concepts. They all tend to exploit the video disk technology. These are interactive devices. They allow the learner visually to manipulate his viewpoints and to examine dynamic relationships. They're affordable and they're often fun to use. The cost of the devices that we're working on will be in the nominal $10,000 range, rather than in the million dollar range of full simulators.

I'm going to show a few short movie clips that illustrate this technology. The first is a concept that we call Surrogate Travel. This is a simulation based on 360 degree photography where we move rapidly through a scene and take photographs in all directions. The technology uses video disks to store up to 54,000 pictures, and then randomly accesses any picture in a maximum of a few seconds, but typically in a small fraction of a second. The idea is to photograph and store pictures, in this case, of a map area. You can take pictures of every street and building and every possible direction, and then the device is programmed so that the operator can move through the scene and he can make choices as to where he would like to turn. This has obvious implications for map training. You'll see a map scene. This, I believe, is Aspen, Colorado. The operator can indicate various turns or he can stop and look around at particular places. It's his choice. He can explore this scene and learn to correlate it with real maps. There are simple touch controls on the base of the picture. We can do this summertime or wintertime and the primary purpose of this is to train for missions, attacks, in the area, but it also has very obvious training implications.

PROBLEM OF SOPHISTICATED, COMPLEX TRAINING DEVICES:

- *ENORMOUS CAPITAL INVESTMENT*

$$\frac{\text{NEEDED PRACTICE (HOURS/DAY)} \times \text{\#LEARNERS}}{\text{DEVICE AVAILABILITY (HOURS/DAY)}} \times \text{CAPITAL COST OF DEVICE} = \$\ \text{DoD CAPITAL INVESTMENT}$$

HYPOTHETICALLY, FOR TACTICAL PILOTS:

$$\text{CASE \#1} \quad \frac{\text{1 HOUR/DAY} \times \text{5000 PILOTS}}{\text{16 HOURS/DAY}} \times \$15\text{ M} = \$\ 4.7\text{ B}$$

$$\text{CASE \#2} \quad \frac{\text{2 HOURS/DAY} \times \text{5000 PILOTS}}{\text{10 HOURS}} \times \$15\text{ M} = \$\ 15\text{ B}$$

GIVEN:

- *VAST TRAINING NEEDS*
- *CRITICAL, HIGH ATTRITION SKILLS*

DoD AND INDUSTRY MUST:

- *EXPLOIT NEW TECHNOLOGIES*
- *PRODUCE FAMILIES OF DEVICES DRAMATICALLY LOWER IN COST*

The next will show an example of this exact same technology that allows what we call microtravel. It allows vicarious journeys into extraordinarily small places, like the inside of mechanical equipment. The traveler can choose his own route. He can inspect items as he goes along and watch components work from a close-up view inside. In this system, the user sits in front of a very similar console to what you saw before. He drives through the engine. He selects different routes and inspects parts of the machine that are of interest. He can command parts to move and he can study their actions while they're moving. He can also deviate from the selected physical path at key points. That is, he doesn't have to follow the gas line. If he's in a cylinder and he decides he'd like to see what's over to the left, he can conceptually burn his way through - you'll see a little laser-like symbol where the man jumps through a physical barrier to see what's on the other side. We believe this can provide very important training which permits relatively unskilled operators to understand exactly what's going on inside a rather complicated machine.

A very similar system will be shown in the next clip, which has to do with the development of a film that can be used for aerial refueling training. This is another example where we take a very small aspect of the pilot's overall mission and work out a simulation. You'll see the training film in development. Here we are approaching the KC-135 tanker from the aft end and there are photographs to simulate what you'd find in the real world. The tanker is photographed from many, many different angles and positions, distances, from the tanker so that in the actual simulation you can develop a very exact picture of what you will see. We've taken a very large number of photographs for efficiency in accessing the information on the video disk. In this case, we took over 48,000 views, which you realize is a lot more than you need to simulate that kind of approach. However, by overdoing it in this way, we can use a very inexpensive microvideo disk technology to do the simulation.

The final scene I want to show you is the tank gunnery trainer. You can see this device and use it yourself - shoot at tanks out in the exhibition area. This integrates a video disk presentation with a graphics overlay. You see a tank appearing on the scene here. There's a computer program in there that keeps exact trajectory of the artillery shell and the operator, using a very realistic front end simulation, which is just the kind of equipment he'd have on the tank, can fire and produce the exact effects that would happen in real life.

We believe it's important to continue on with this kind of development and the next step will be to produce a network of a number of these trainers that can work together to practice combined tactics. For example, you could simulate three

friendly gunners firing upon four hostile vehicles. You could probably also develop very realistic games that simulate actual combat. You could have a red team and blue team in principle working against one another by following this cheap technology.

We realize that devices of this type will not produce the full-scale simulations, nor will they eliminate the need to practice with real equipment. But we believe they can make use of such practice much more effective when it does take place on more expensive simulators.

So I'd like to leave you with our belief in the need for far more effective and lower cost training devices, especially those that can simulate danger situations or realistic battle situations, and we think it's very important to extend this to team applications. These are points I think you'll recognize that General Starry also stressed. Thank you very much.

Mr. Merl

Thank you very much, Dr. Romney.

The last of our speakers on the DOD overview portion of this session was to have been LGEN R. Dean Tice, Deputy Assistant Secretary of Defense for Military Personnel and Force Management. General Tice had to stay in Washington, had to testify today on the subject of retirees' pay, and I guess he made the proper decision to stay. He has, however, sent his paper and an ample representative in selecting the Deputy Director of Training and Education in the Office of the Deputy Assistant Secretary of Defense for Military Personnel and Force Management, Colonel Frank E. Hines, U.S.Army.

Colonel Frank E. Hines, USA

Ladies and gentlemen, it is a pleasure for me to appear before this distinguished group. My office is responsible for policy and program review across the whole spectrum of training. Over the years, the attitude of the training staff in the Office of the Secretary of Defense toward simulation has changed radically, from an attitude of mild interest in the 1960s to an intense interest in simulation as a means of saving money and fuel in the 1970s to a concentration today on using simulation to enhance the effectiveness of training. I plan to discuss the reasons for this evolution and attitudes towards the potential for simulation and in particular, the rationale that brings us to the position we hold today.

The attitude of the military services toward simulation has historically been somewhat ambivalent. While a few military offices recognized the advantage of simulation early on, most offices tended to be luke-warm at best on simulation because they felt the only good training was on the system itself.

An example from the early days of simulation will show that this attitude can lead to dubious conclusions about the usefulness of simulation. Some of you may have read the recent obituary of Edwin Link, the father of flight simulation. Link developed the first model of the famous Link trainer in the late 1920s, but the Army Air Corps wasn't interested. A few years later, the Air Corps was given the mission of flying the mail. They quickly discovered that its pilots were crashing at a distressing rate because they were inadequately trained in instruments, and the Air Corps was very quickly knocking on Edwin Link's door. The Link trainer, of course, became the mainstay of pilot training and remained one for decades. The point I would like to make and one that I'll return to is that the Air Corps originally adopted the Link trainer not so much because it would save money but because it provided a new dimension in training effectiveness.

Simulator development proceeded only slowly after World War II, partly because of the ingrained bias against simulators in some quarters, but mainly because the technology had made no real advances and the training capability wasn't yet available. The Office of the Secretary of Defense did not take an active role in guiding simulation policy during this period. This go-slow approach to simulation ended with a bang in 1973, when both the General Accounting Office and the Office of Management and Budget issued reports encouraging the Department of Defense to develop, buy, and use flight simulators to replace maximum amounts of actual flight for training. The intent of these two agencies was, of course, to save money. This viewpoint was strongly reinforced by the oil embargo following the Yom Kippur War. Defense officials had ample time, as they waited in gas lines, to ponder two obvious points. First, no one knew how high fuel prices were going to go. To the degree that simulators could replace some number of flying hours, there was a tremendous, almost undefined potential for savings in Defense fuel bills. Second, if there should be a prolonged and severe shortage of fuel, training in simulators was better than no training at all.

These events led to the appointment within the Department of Defense of the Flight Simulator Study Group. In retrospect, it is clear that the study group was unduly influenced by the success of some airlines in replacing almost all flight for training with simulator training. This example led the study group to take too little account of the differences between the airlines and the Services, particularly in composition of the student population and the skills that had to be learned. The airline students were highly experienced pilots. The military students ranged from highly experienced pilots to novices learning how to fly. The airlines' main objective was to train the pilot to take off, fly level, and land the aircraft that they had not flown before. The military Services' objective was to train pilots in a variety of complex aerial maneuvers necessary for the missions of many different types of aircraft. In any

case, the study group took a bold leap into the unknown and proposed this goal. The Secretary of Defense approved the goal. The Congress, not surprisingly, thought it was a great idea and directed the Department to report annually on its progress.

As events have turned out, the 25 percent goal has been good news and bad. First the bad news. Aside from the fact that no one knew if the goal was feasible, it wasn't clear just what the goal meant. To be successful in satisfying the goal, was it necessary to reduce flying hours by 25 percent? Or would it suffice to make real progress towards the goal. More importantly, how do you measure progress? This slide represents the problem. The bar represents notionally total flying hours in a year. We know two things - first, we know the number of hours that have been actually flown in a year or that are budgeted to be flown in a future year. Second, we know the required number of hours the Services say they would have to fly if they had no simulators. The latter number may or may not be correct, since equally qualified experts are likely to provide estimates of flying hour requirements that vary over a wide range. The monies funded are almost never the same as required, because of the competition for scarce funds. As a result, the real savings through simulation are probably less than reported, but since a lesser figure is unknown, it can't be used to show flying hours saved. So there is some hocus-pocus about these computations, despite their honest intent.

This shows some of the perils of over-reliance on cost savings as a justification for simulation. The Department is no longer required to submit the annual report to Congress, or to make nebulous qualifications and calculations about the flying hours saved. The last time we figured it out, the reduction in flying hours attributed to simulation was about 16 percent. I doubt if 25 percent could be achieved under current technology without an unacceptable loss in training effectiveness. On the good news side, the reports to Congress on progress towards the 25 percent goal help to create a very favorable atmosphere for funding for flight simulator investment at the rate of about $300 million per year. Events have proved that this was a very wise investment, even though in hindsight the original justification for making the investment was not always the best.

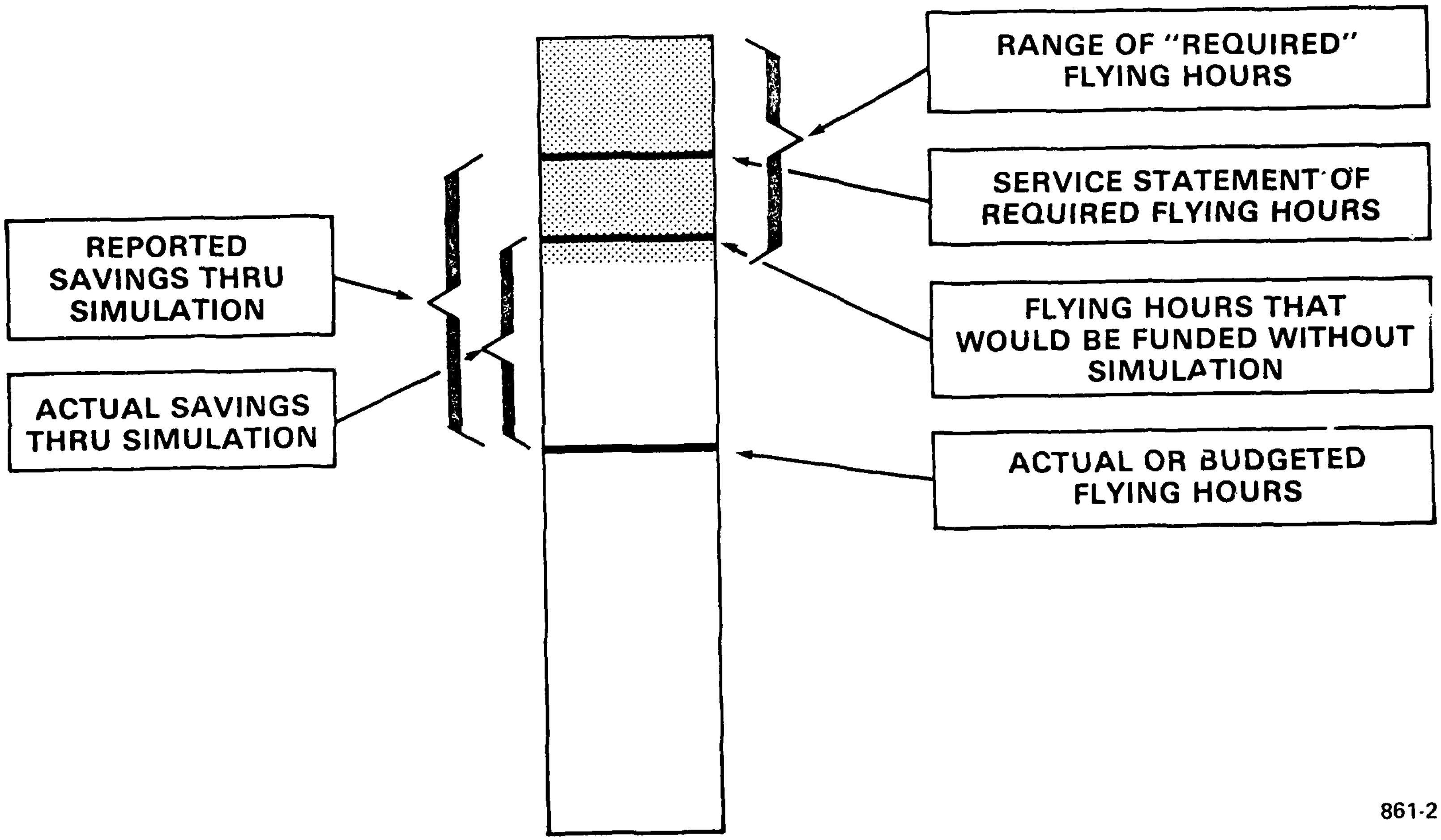
Over the past two or three years, my training staff has had more opportunity to observe simulations in the field and to expand their attention to simulators other than flight simulators. Most of the simulators we have observed are very effective in providing much better training than would otherwise be available. As a result, the idea began to grow in the Department of Defense that maybe we have our priorities backwards in justifying simulation. Instead of concentrating on savings first and improvements in training second, perhaps it would be more correct to concentrate first on what simulation can do for training effectiveness and second on what it can save.

"A GOAL TO REDUCE FLYING HOURS BY *25% BEFORE 1980 IS BEING PROPOSED."*

DEPARTMENT OF DEFENSE, "FLIGHT SIMULATION REPORT TO THE CONGRESS, 1974."

687-2

MEASURING PROGRESS TOWARD THE 25% GOAL



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This leads us to a set of tentative priorities; perhaps guidelines is a better term. What I am suggesting here is that we approach simulation decisions - and here I'm talking to the people who design and make simulators, as well as the Department of Defense people - by asking ourselves how can I use simulation to improve training effectiveness and thus improve combat readiness. In many cases, I think we will find the improvement in training effectiveness and proficiency will, by itself, justify the cost of the simulator. If savings and operating costs in such cases are also feasible, they can be regarded as a welcome bonus.

Rather than discussing these guidelines at this point, I want to talk a bit about five simulation systems that illustrate the rationale behind these guidelines.

The first is the synthetic flight training system used by the Army in its undergraduate helicopter training course and elsewhere for training UH-1 pilots. This simulator is only one of many that could be used to make some of the same points. It was originally procured with the objective of saving operating costs. Such savings are, in fact, being realized. However, the value of the device in delivering high quality training is at least as impressive. A student can practice routine maneuvers which can be played back to demonstrate faulty procedures. The faults can be eliminated through repetitive practice. The simulator also allows training for recovery from in-flight emergencies that would not be deliberately induced in flight. I have a quotation that illustrates its capability very aptly. Two years ago, a senior Marine aviator was testifying before the Congressional Committee on helicopter pilot training. He had this to say about Army helicopter simulators. "I was flying the simulator at Fort Rucker and they gave me an engine flame-out and a tail rotor failure. It nearly scared me to death. I couldn't have survived it in an airplane, but I got to practice it at Fort Rucker, and you can practice every other emergency that can be given in an airplane."

The next simulator I would like to discuss is the conduct of fire trainer for the Abrams tank. This particular simulator has recently been tested by the Army and the test results are being evaluated. I don't know if this particular device will be adopted, but I do know that there is a very real need for a capable conduct of fire trainer. There may be potential cost savings, especially in ammunition. But our thinking is that a capable conduct of fire trainer should be able to justify itself by raising the level of crew proficiency, especially for crews in tank units stationed in Germany. As you know, range space in Germany for firing the main gun is extremely limited. That space that is available is in use almost around the clock, seven days a week. A typical tank crew gets only about one extended gunnery session per year. Proficiency dwindles during the rest of the year, and this loss is aggravated by the fact

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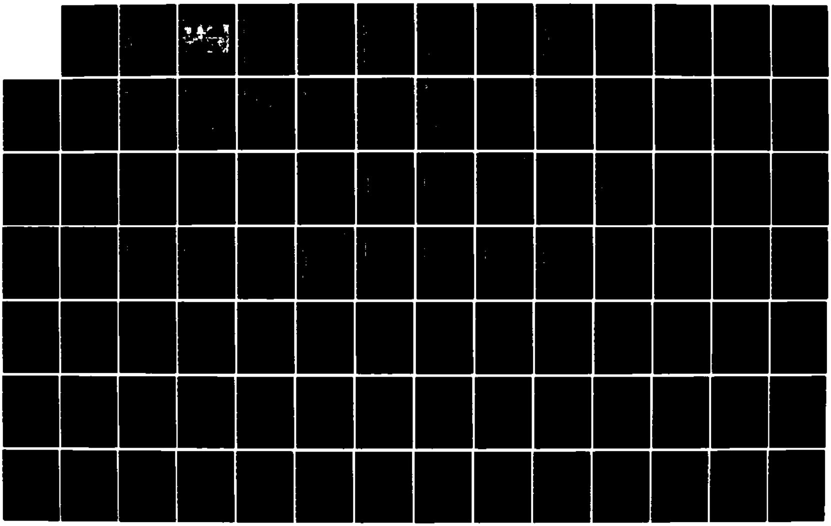

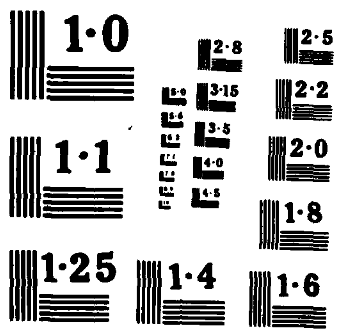
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GUIDELINES FOR DECISIONS ON SIMULATION

1—IMPROVE EFFECTIVENESS OF TRAINING
- TRAINING THAT OTHERWISE CAN'T BE PROVIDED
- REPETITIVE PRACTICE OF ROUTINE ACTIONS
- DIAGNOSIS AND CORRECTION OF FAULTY PROCEDURES
- SUSTAIN HIGH PLATEAU OF PROFICIENCY AND READINESS

2—SAVE IN TRAINING COSTS:
- OPERATING COSTS (FUEL, AMMO, MAINTENANCE)
- REDUCED REQUIREMENT FOR MAJOR SYSTEMS
- REDUCED TRAINING TIME

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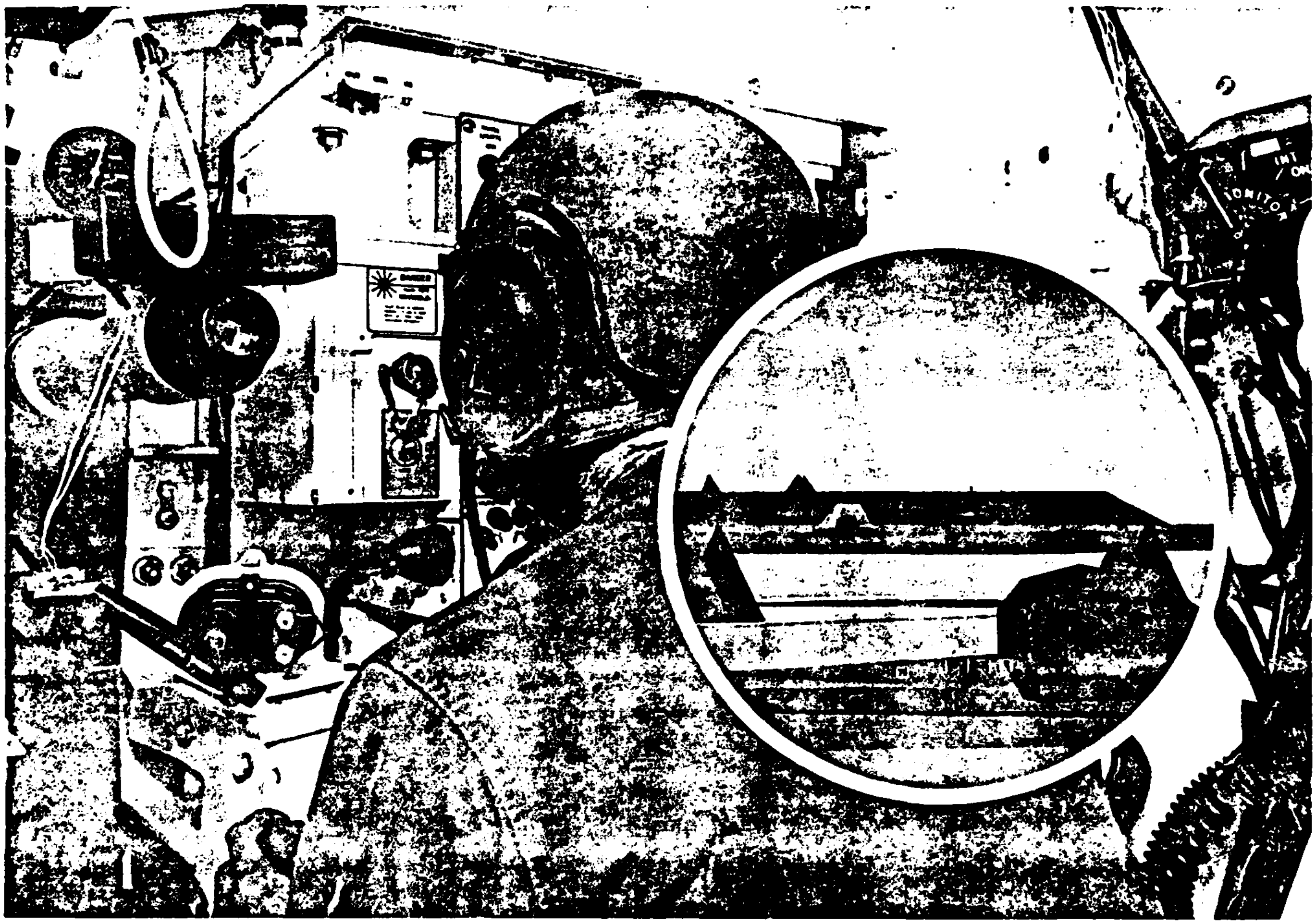
Conduct of Fire Trainer (COFT)



BENEFITS OF A CAPABLE COFT

- RAISE THE YEAR-ROUND LEVEL OF CREW PROFICIENCY
- INCREASE THE TRAINING VALUE OF LIVE FIRING
- ALLOW CROSS-TRAINING OF ALL CREW MEMBERS

RESULT: HIGHER PROBABILITY OF SUCCESS AND SURVIVAL ON THE BATTLEFIELD.

687-2

that probably either the tank commander, the gunner, or both will leave the crew and change positions during the year. A capable conduct of fire trainer could do three things. It could iron out the valleys in crew proficiency and by keeping the crew up to speed, make the annual firing sessions a more effective learning experience. The device could also provide a means to cross-train tank drivers and loaders as gunners and tank commanders, thus easing the problems of adjusting to personnel losses, both in peacetime and wartime. If a conduct of fire trainer could boost crew proficiency even a moderate amount, say 5 or 10 percent, its contribution to combat effectiveness in the Army in Europe should fully justify its cost. This is purely speculative, of course, because full information is not available. But it illustrates the concept that a simulator may justify its cost solely by what it can add to readiness without necessarily having to produce savings in training costs.

My next example is a van mounted, pier-side trainer being developed by the Navy for in-port team training of personnel who man the combat information systems in sonar control rooms of frigates of the Perry class. Jim Henris mentioned this trainer this morning. My interest, though, is in discussing its justification. The Perry class frigates must be able to operate effectively in a tactical environment that includes simultaneous threats from submarines, surface ships, aircraft, and anti-ship missiles. It is difficult and expensive to assemble even part of this threat in an exercise at sea. It is not possible to integrate some parts of the potential threat, such as incoming anti-ship missiles. Without the simulation provided by such a trainer, the frigate's crew simply could not develop team proficiency. There may be some resultant operational savings, but the main advantage to the tax payer, it seems to me, is in having a crew that can operate the ship at or near its combat potential, rather than at some lower level.

Next I'll discuss a set of maintenance simulators that the Air Force is using to give transition training to maintenance personnel of units that are changing from the F-4 aircraft to the F-16. This simulator set has the capability to do about everything in terms of satisfying the objectives of the simulation as I've described them. It can make training more effective than training on an actual aircraft. For example, the engine simulator can be so adjusted that it is out of tune, allowing the mechanic to practice tuning the engine. As you know, de-tuning of an operational engine on an operational aircraft would obviously be unwise. Without the simulator, the mechanics would learn less because they could not get the hands-on practice in tuning procedures. On the saving side of the ledger, I'd like to mention two aspects of savings in training time. Students in training are not available for operational tasks, so longer times in training drives

PIERSIDE COMBAT SYSTEM TEAM TRAINER FOR PERRY-CLASS FRIGATES

- ***THREAT ENVIRONMENT:*** SIMULTANEOUS SURFACE, SUBSURFACE, AIR, EW THREATS.
- ***JUSTIFICATION:***
  - ALLOWS INTEGRATED TEAM TRAINING IN COUNTERING ALL ASPECTS OF THE THREAT.
  - ALLOWS TRAINING THAT OTHERWISE COULD NOT BE FULLY PROVIDED.
  - PRODUCES A CREW THAT CAN OPERATE SHIP AT OR NEAR ITS FULL POTENTIAL.

687-2

F-16 MAINTENANCE SIMULATORS

TRAINING EFFECTIVENESS: ALLOWS INTRODUCTION OF FAULTS THAT WOULD NOT BE PERMITTED ON AIRCRAFT.

SAVINGS:

- FEWER AIRCRAFT REQUIRED
- LESS FUEL AND WEAR AND TEAR ON AIRCRAFT
- REDUCED TRAINING TIME

687-2

up total Air Force manpower requirements. Savings resulting from shorter courses can therefore be roughly measured by the cost that would be incurred to pay and support the students during their period of training. Shortening the course by only a day or two can produce very large savings if there is a large volume of students. The second aspect of the savings derives from the reduced requirement for aircraft for maintenance training. Unless the Air Force buys extra aircraft to dedicate to maintenance training - and that's a very expensive proposition - it must borrow aircraft primarily intended for flight training. Now this, in turn, requires the student pilots to stay in training longer. This costs money and it also stretches out the period that the squadron in transition is not combat ready.

My final example is the instrumentation that the Army is completing at the National Training Center at Fort Irwin, California, for use in opposing force maneuvers. The overriding objective in combat is to accomplish the assigned mission, but to do it in a way that minimizes casualties. However, measuring success of ground maneuver units in meeting this objective has been based mainly on the subjective judgement of control personnel. It could be said that the basis of judgement is not a great deal more advanced than six-year-olds playing cops and robbers. Bang, bang, you're dead. No, I'm not. In consequence, some of the lessons learned in conventional force maneuvers may be valid, some may be only partially valid, and some may be dead wrong. Learning the right answers about trial and error in combat can be extremely costly. The concept of the National Training Center is to teach the right answers by using low-intensity lasers and laser detectors to determine immediately who shot whom. The control network picks up all details, including position locations, shots fired, hits and misses, for post-exercise critiques. As a result, exercise controllers are given the means for objective analysis of unit performance. For soldiers and their leaders, these exercises become profound learning experiences that really improve a unit's potential to survive and win in combat. The pay-off is not in money directly saved, but in more effective training and tactics that work.

I'll end by returning to the guidelines for decisions on simulations that I suggested to you earlier. As I believe the examples I've discussed show, simulation can make such marked improvements in the effectiveness of training that many simulators can be justified mainly or solely on the effectiveness dividend without necessarily demonstrating savings. Obviously, common sense is called for. We can't afford to spend a bushel of money for a teaspoon full of effectiveness. I am suggesting that the principal focus, although not the only focus, should be on improving the quality of training. If resources can also be saved, we should by all means realize that savings. But we should not force the production of savings to such an

SIMULATION IN OPPOSING FORCES MANEUVERS NATIONAL TRAINING CENTER, FORT IRVIN, CA

INSTRUMENTATION:

- DIRECT-FIRE WEAPONS EQUIPPED WITH LASER EMITTERS.
- COMBAT VEHICLES AND SOLDIERS EQUIPPED WITH LASER DETECTORS.
- HITS AND NEAR-MISSES SIGNALED.
- CENTRAL CONTROL STATION RECORDS ALL DETAILS OF BATTLE FOR CONTROL AND CRITIQUE.

RESULTS:

- OBJECTIVE ANALYSIS OF UNIT PERFORMANCE.
- MAXIMUM LEARNING BENEFIT.

687-2

GUIDELINES FOR DECISIONS ON SIMULATION

1—IMPROVE EFFECTIVENESS OF TRAINING
- TRAINING THAT OTHERWISE CAN'T BE PROVIDED
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- REDUCED REQUIREMENT FOR MAJOR SYSTEMS
- REDUCED TRAINING TIME

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extent that the reduction in conventional training activities required to generate that savings nullifies the net gain in effectiveness that was our principal objective.

It has been a pleasure discussing these matters with you and I thank you for your attention.

Colonel Campbell

Thank you, Frank. Dr. Romney had to move out swiftly to tag onto Dr. Sculley's aircraft back to Washington, so we don't have a real question and answer session.

After last year's conference I had a lot of comments from a lot of people about what we used to call the new business. We'd throw things up on the screen and give you a lot of projections for the out years and we'd say, if you can get interested in this or this or this - if you all are really as good as I think you are or we all think you should be, I think you pretty much know right now what we need and what we really have to offer in the way of those kinds of slides. It's not too difficult to get the figures and it's not too difficult to search out those needs that the Services are really interested in. So this afternoon we decided to structure this thing just a little bit differently in hopes that it would be a little more give and take, and maybe a little more interesting for those of you in the audience and also to us up here who are listening to the questions and answers.

So what we've got is Dr. Jim Harvey, who is the Technical Director of the Naval Training Equipment Center, and we've got Dave Glenn, who is the Assistant Director, USAF Deputy for Simulators, and then we've got Lt. Col. Bobby Adams, who is my Director of the Aviation Division. They're going to throw some challenges and thoughts at you. After the three of them have finished, we'll open it up to questions and answers and we'll kick it around here. Jim, your shot.

Dr. James F. Harvey

Good afternoon, ladies and gentlemen. For the next 20 minutes or so, I'm going to talk about some of the progress and some of the impediments that we see in the Navy in bringing a viable product to the Fleet. I'm going to talk about acquisition first, then move on through support, and then finally talk about some of the technologies we have to deal with.

In the last year or two, we've had, in my view, a lot more luck with best value type contracts. In the past, NTEC was notorious for its two-step, auction-type bids where the lowest bidder took all. In the more recent past, we have had this best value notion, which is working. We hope for a better product. We hope for less binds. We're beginning to learn the cost of that, however. The time to award is somewhere in

excess of 300 days and the effort, both to the Navy in terms of the evaluation process, and the cost to the contractors is enormous and as we discussed during the Executive Session on Sunday, it's really untenable. We're going to get our heads together to see what we can do about reducing the time and therefore the cost.

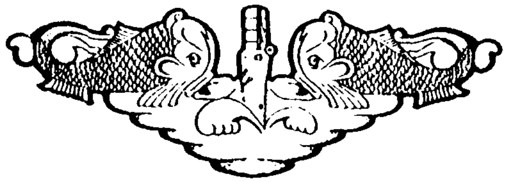
In the area of performance specs, we still hold to the policy that NTEC is trying to maintain a posture where industry comes in with a solution to our problem rather than us specifying what we think is needed. That turns out to be much more difficult than we first thought. There are a number of inhibitors to that. First of all, of course, you have to establish a cost estimate way ahead of the contract award, and that, of course, is based on some design concept. It turns out that it's very difficult for us to remove that preconception from the spec. There are a number of cues that we need to call out, such as the visual cue, which by their very nature are extremely difficult to write in performance terms. Motion is another one. You've all, from time to time, come across our computer problems and the one in which we call out for specific computers. We're trying to work against that. We're driven by various considerations, including the logistics and support of the trainer.

Finally, it is undoubtedly more difficult for the Navy or the evaluator to look at proposals based on performance specs and evaluate them to determine which is the best, because the breadth of the solutions is greater. But we are trying. We're not going to fall off this and please be patient.

One or two years ago, we had a Mark-1 disaster in software development. I think now we just have a 9 on the Richter scale - it's getting less. The attention and the discipline that industry has given to this in the recent past is highly commendable. We are making progress and I would like to thank you all for that. From our standpoint, we have spent an inordinate amount of money training our people in software development, software management, and I think we understand the problem better ourselves. I'd like to claim a little bit of credit on behalf of NTEC for the 1644 initiative. It came at a time when something was needed to precipitate a greater focus and we achieved that, you responded, and we thank you. At this point in time, as we discussed on Sunday, we may well be in an overkill mode now that all of you are working this thing hard. And we may well, if we can get together with the other two Services, throttle back a little on our requirements here. The momentum that's been developed seems to be carrying forward. We're seeing more and more companies automatically moving into the next step and bringing on line software CADCAM systems. That's very encouraging.

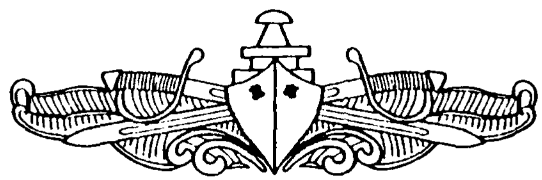
An issue which is delicate to handle, I guess, is support contracting. NTEC and the Navy is no different than any other component within DOD and we are seeing much more support

NAVY COHESIVENESS



- POLICY DIFFERS WITH:
  - INDIVIDUAL PM'S
  - PLATFORM SPONSORS
  - MAJOR CLAIMANTS

- TRAINER COMMUNITY CANNOT:
  - STANDARDIZE ACQ PROCEDURES
  - TRANSFER EXPERIENCE
  - UTILIZE COMMON TECHNOLOGY
  - SUPPORT EFFICIENTLY



ACQUISITION

OUT-YEAR EMPHASIS

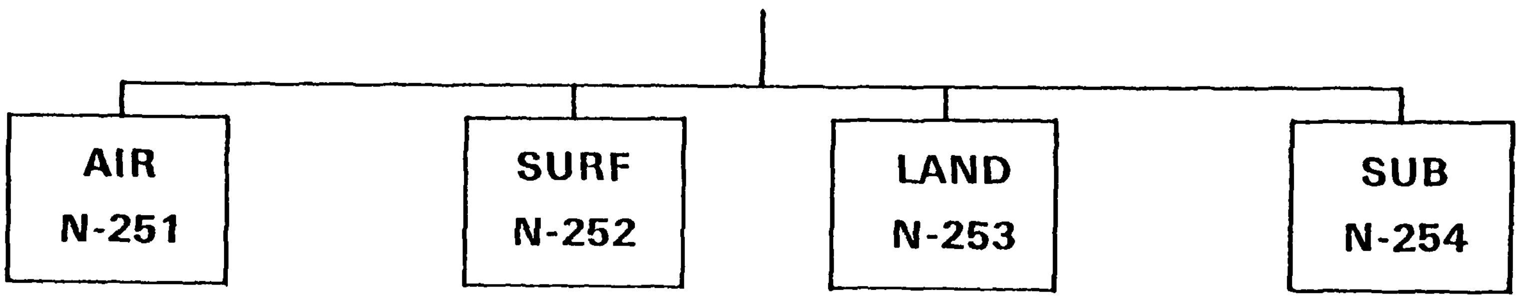
- MAINTENANCE TRAINERS
- MODIFICATIONS/UPDATES
- SURFACE TRAINERS

64-B

ACQUISITION

FRONT END ANALYSIS

- NTEC NOW ORGANIZED UNAMBIGUOUSLY
- NOW ROUTINE
- PRECIPITATES "SYSTEMS" LOOK
- OVER $5M SPENT IN FY 81



ACQUISITION

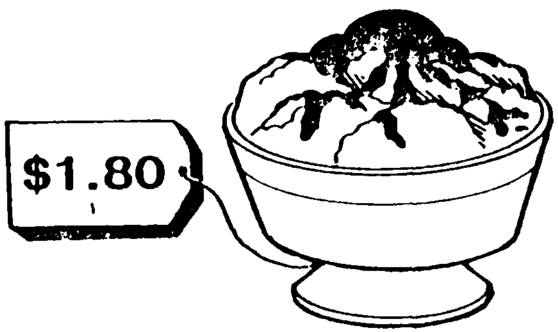
LESS TROUBLE WITH SOFTWARE DEVELOPMENTS

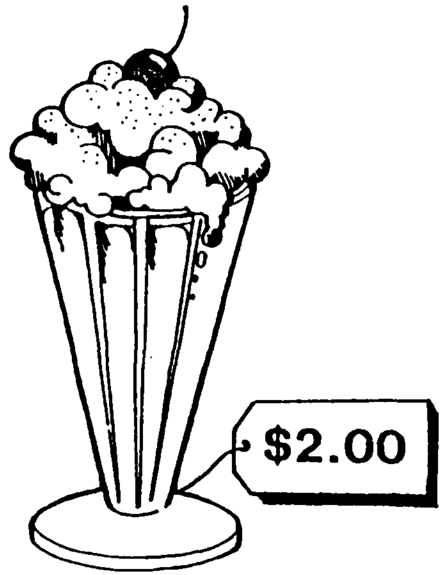
- MORE INDUSTRY DISCIPLINE AND ATTENTION
- MORE MUTUAL KNOWLEDGE
- MIL-STD - 1644A (TD)
- SOFTWARE CAD/CAM

ACQUISITION

MORE BEST VALUE CONTRACTS

- BETTER PRODUCT
- DECREASE 'BUY-INS'

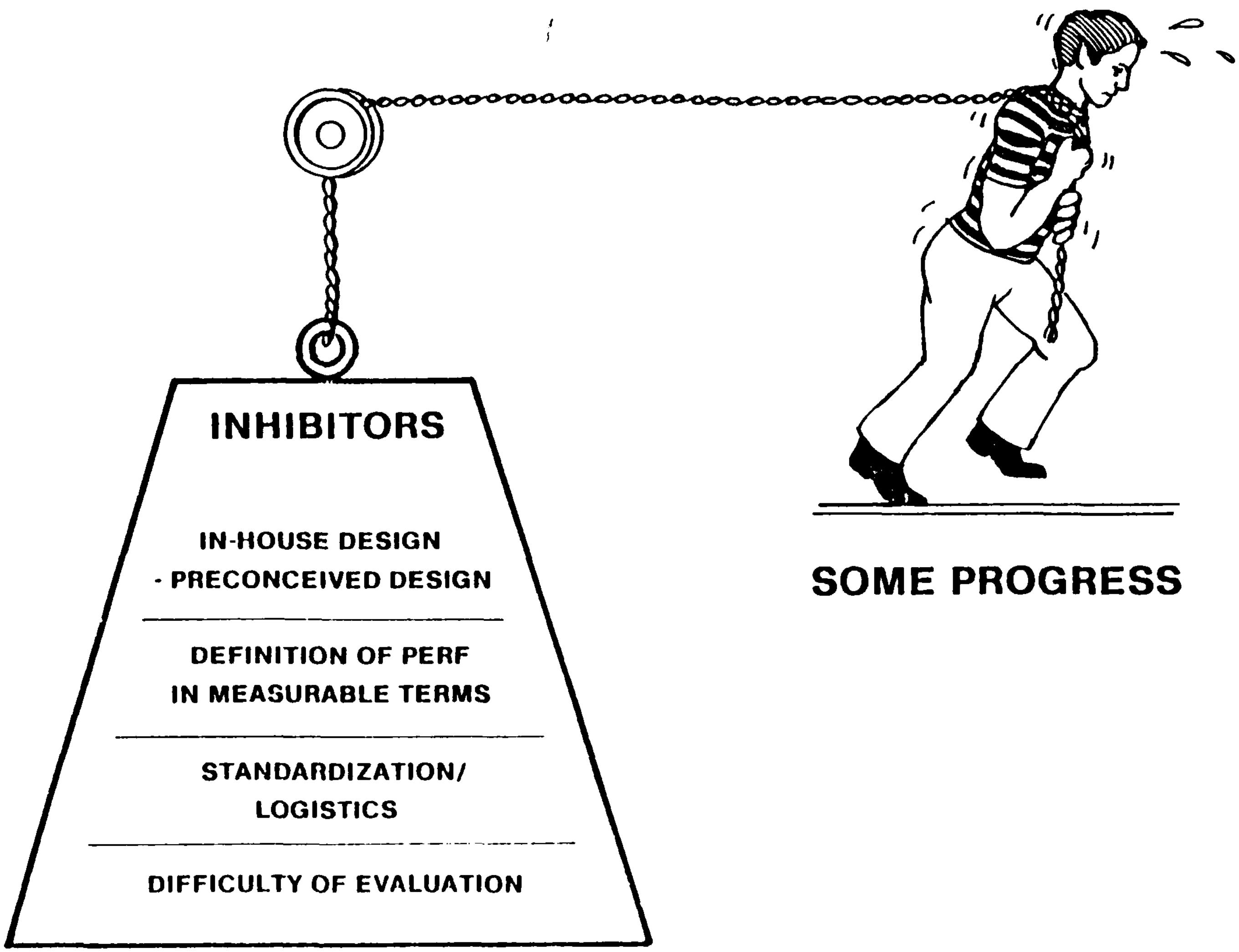




- TIME TO AWARD
- EFFORT IN SELECTION
- COST TO BIDDERS

ACQUISITION

PERFORMANCE SPECIFICATION



TIME TO AWARD

PRIMARY DRIVERS:	DAYS
• RFP RESPONSE TIME	~ 60
• PROPOSAL EVALUATION*	~ 60/90
• HQ APPROVALS	~ 60
• EEO/OTHER ADMINISTRATIVE ACTIONS	~ 10
	~ 200

*AFFECTED BY QUALITY AND QUANTITY OF PROPOSALS

contracting for a variety of reasons. I don't want to go into the causes, but I'd like to throw out some problems that arise because of that trend.

I think it's incumbent upon the contractors to choose what role they want to play. If they're going to be a support contractor doing work within the walls of Government, as it were, getting involved in the work packages that go to make up an RFP, it is improper, next time around, to bid and come in for hardware. You cannot oscillate backwards and forwards in your role without losing credibility. It's embarrassing to you and it's embarrassing for us.

Another point - industrial integrity. In the last few years, as you all well know, there has been a tremendous push to establish codes of ethics for Government employees. It's very clearly defined. When we provide a contract to a support contractor, those rules do not pass through in the same way and the contractor is essentially on his own terms to establish what the ground rules are. If he misses the boat here, he can really mess it up for everybody.

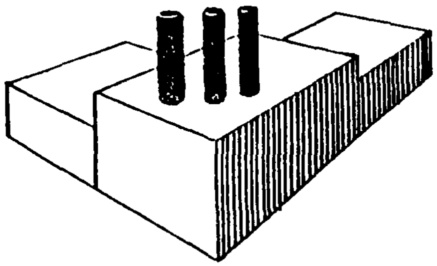
I'd like to jump to the next one - conflict of interest. It's a subset of all the others, though this is the main set. We seem to see in a lot of the support contractors a lot of strange relationships. They are subsidiaries of a bigger company or they have a consortium, or the number of different corporate entities that exist are myriad. We have to establish control and we intend to establish control, but I think it's incumbent upon all of us to say that that's unacceptable if somebody is subbing to a prime in an area where it is improper to do analysis or to be in the support role in essentially the same area. I think self-discipline is the watchword in this line.

In terms of where the Navy dollars are going, just in one slide, I think you've seen today that maintenance trainers, both because of the complexity of the weapon system and because they are an untapped area for us, historically simulation has been the purview of the operator and the team trainer. The amount of penetration that the simulation community has made into maintenance training has been far less. And so those two things combined team up to make maintenance trainers a very viable marketplace in the next few years. In terms of who is the most active sponsor within the Navy, I think it's fair to say that the surface Navy has the most dynamic RDT&E program with the largest number of first articles, new starts, and it's a very vibrant simulation program.

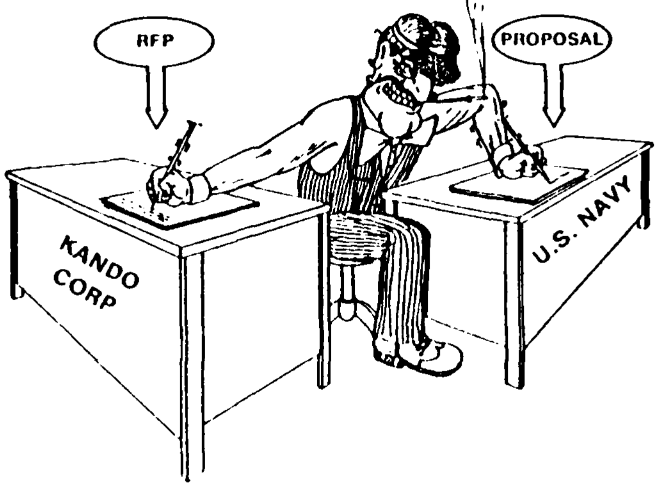
On the air side of the community, we are seeing - mainly because there are no new weapon systems coming down the pike that haven't already been contracted for, F-18 was mentioned, the AV8B is closing to award, VTXTS - there's nothing new and grand out there and most of the effort is going to be in modifications and updates to our trainers.

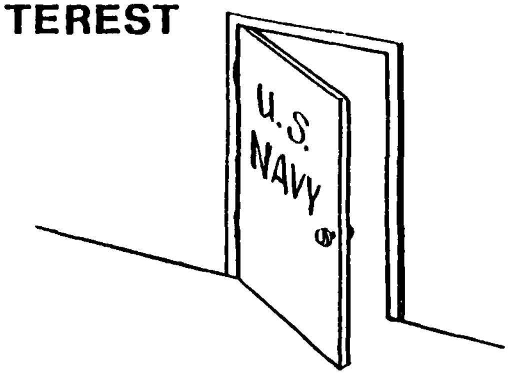
ACQUISITION

SUPPORT CONTRACTING



- CHOOSE ROLE
- INDUSTRIAL INTEGRITY
- PROPER GOVERNMENT CONTROL/USE
- CONFLICT OF INTEREST
- PLANT ACCESS





Moving now to support, two years ago we had this tremendous new initiative, a large amount of dollars were spent on the trainer community and we're now beginning to see the beginning of that wave come into the inventory. Around 1980, these major trainers entering into the Fleet takes upon a new slope. They're a new generation of trainers. They are highly complex. They come at a time when the very existence of the . . . rate, which is the principal rate that supports these devices, is in question. Should it be disestablished? The quality of the TD, partly because he doesn't know of his future; the numbers of the TDs; the whole issue there is demoralizing. I think you're about to see a tremendous change in the way that trainers are supported in the Fleet. It represents an opportunity for everybody because I think the way it's going, contractor support will be the name of the game. That, in turn, cascades back and modifies the way in which we acquire the trainers; the amount of documentation and support that we provide will be different.

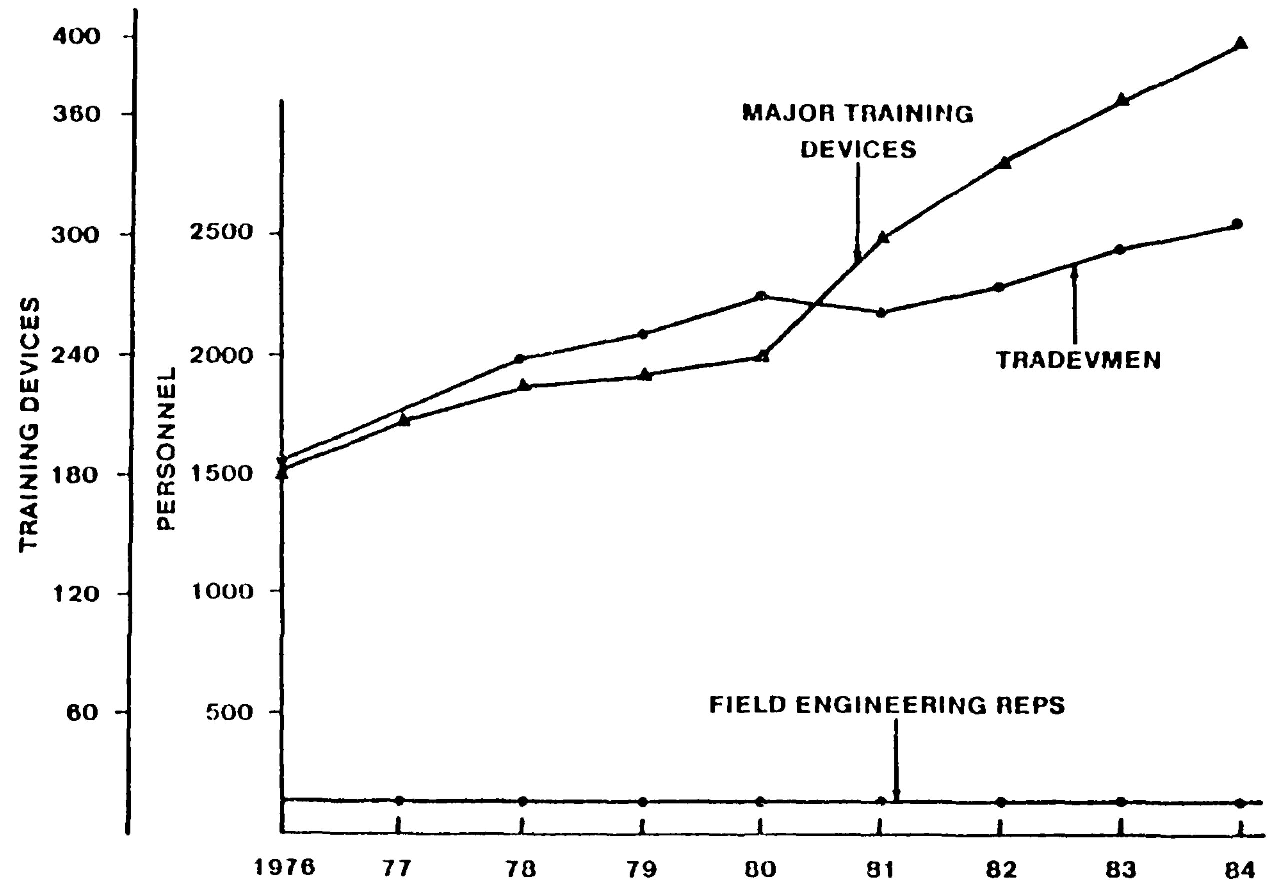
Let me talk about another issue which is kind of intriguing. There was a time, if you look at the solid line, when we could expect that a major component, such as a computer, would have a lifetime which was comparable with the development and operational life of the trainer itself. And they reached the end of their life together, or reasonably together. But what we are seeing now is that in the componentry area, the production time is getting less and less and for major trainers, their development time is pretty much what it used to be. That disparity that is occurring is causing the embarrassment of having a product just go into obsolescence as we come out of interim support. And we have another 15 years to go where production is unavailable to us. And so we're going to have to look at new ways of supporting it, spares wise, and that talks to things like life of type. Life of type is fine providing the money is available to buy those spares. Historically, that has been the first line item to go. If it goes now, there won't be the production available to get them.

I'd like to talk a little bit about some of the technologies we're dealing with. In the visual area, we seem to be spending an enormous amount of money, an ever-increasing amount of money, pursuing wider field of use and ever-increasing image detail. We are solving the problem by putting more and more projectors in and using the brute force approach to solve the problem. The maintainability is obviously going to suffer. The cost is going out of sight. I can't help but believe that if we go 10 years ahead and then look back, we're going to laugh at this stage in visual development. We need something which is much more elegant, something which in my view depends perhaps on instanteous field of view, eye tract, head tract, put the image where you need it. This, I think, is a cul-de-sac.

Let's talk a little bit about man-machine interface. We mentioned earlier that one of the big opportunities is in maintenance trainers.

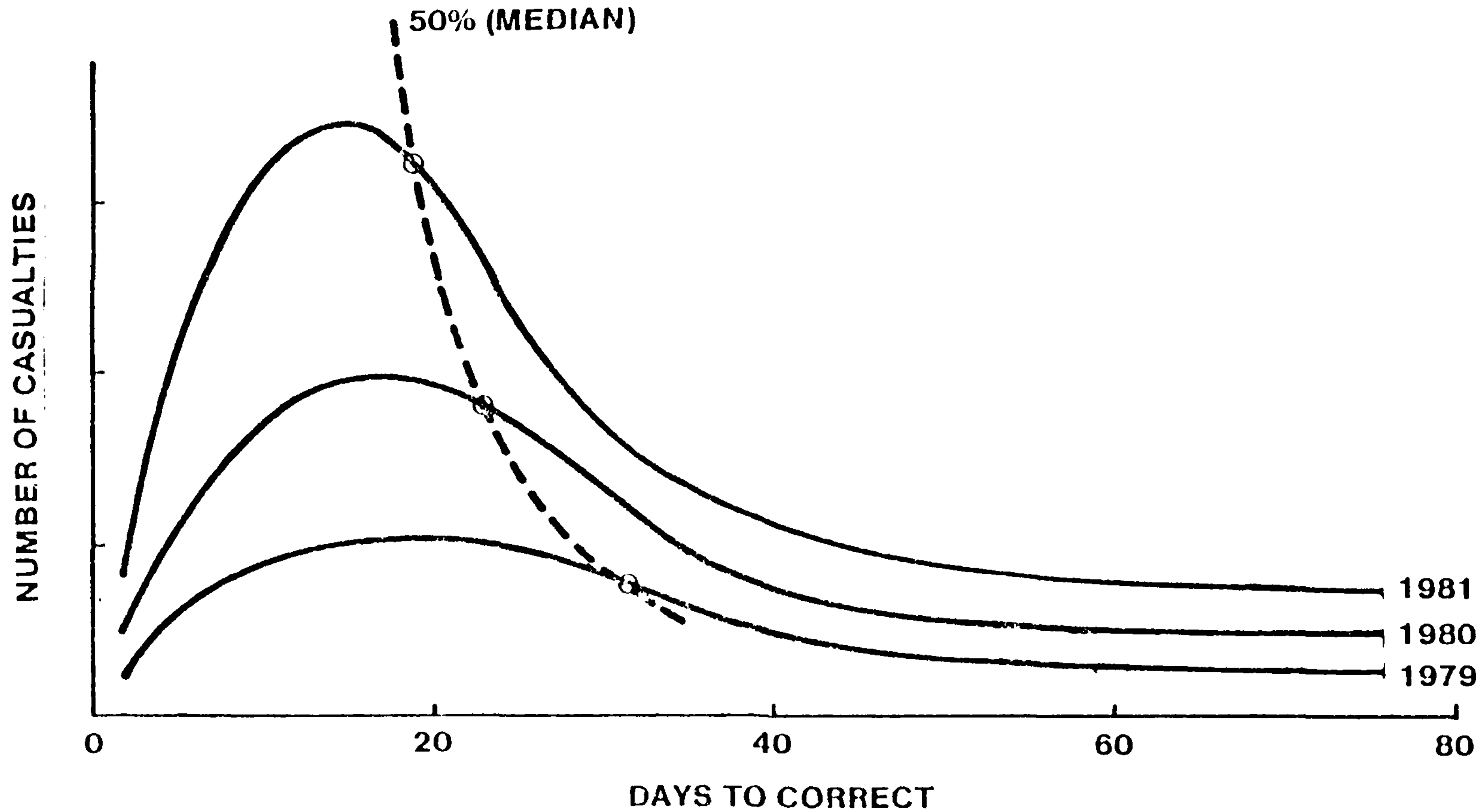
SUPPORT

SUPPORT PERSONNEL



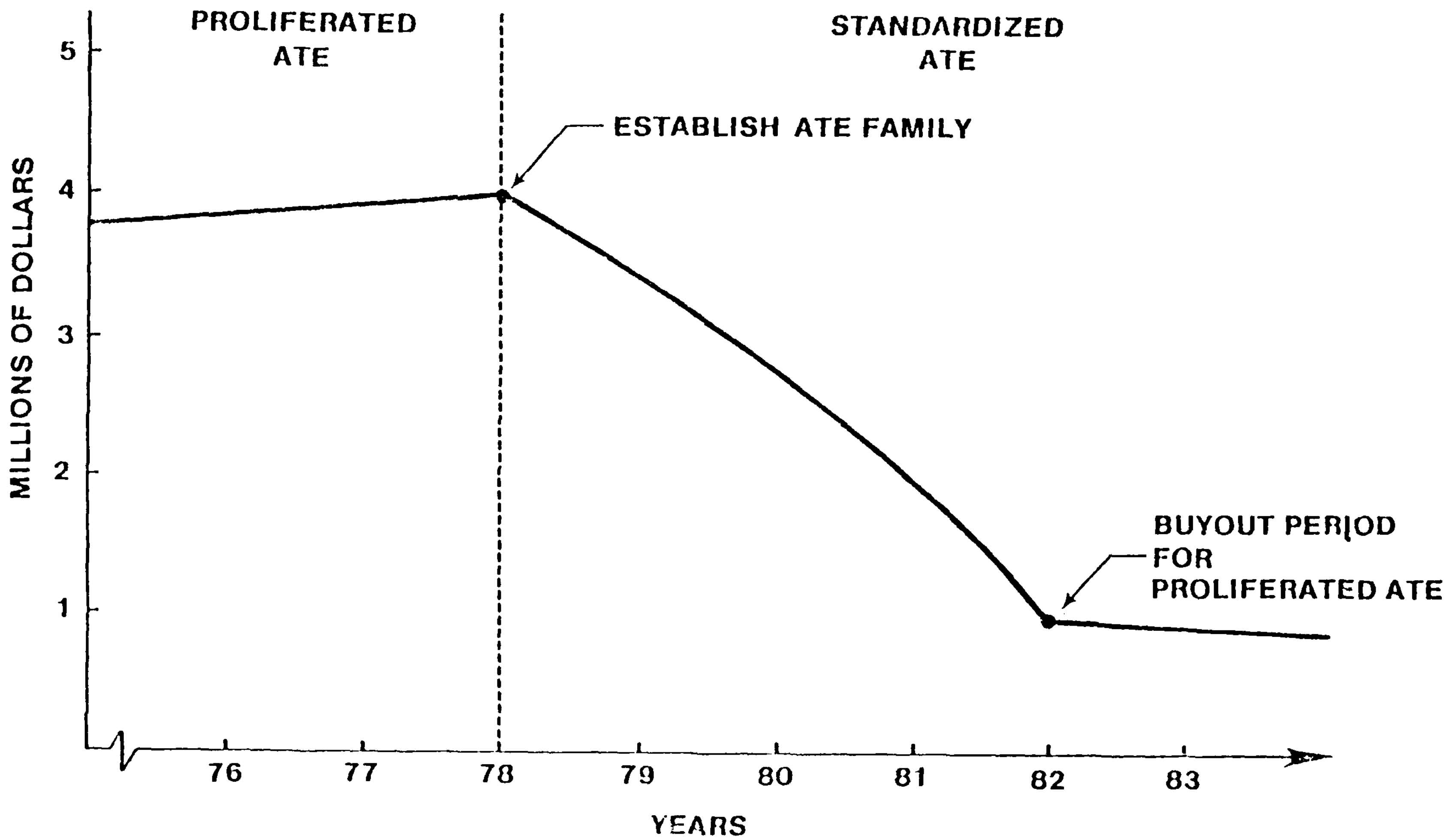
SUPPORT

TRAINER CASUALTIES AND DAYS TO CORRECT



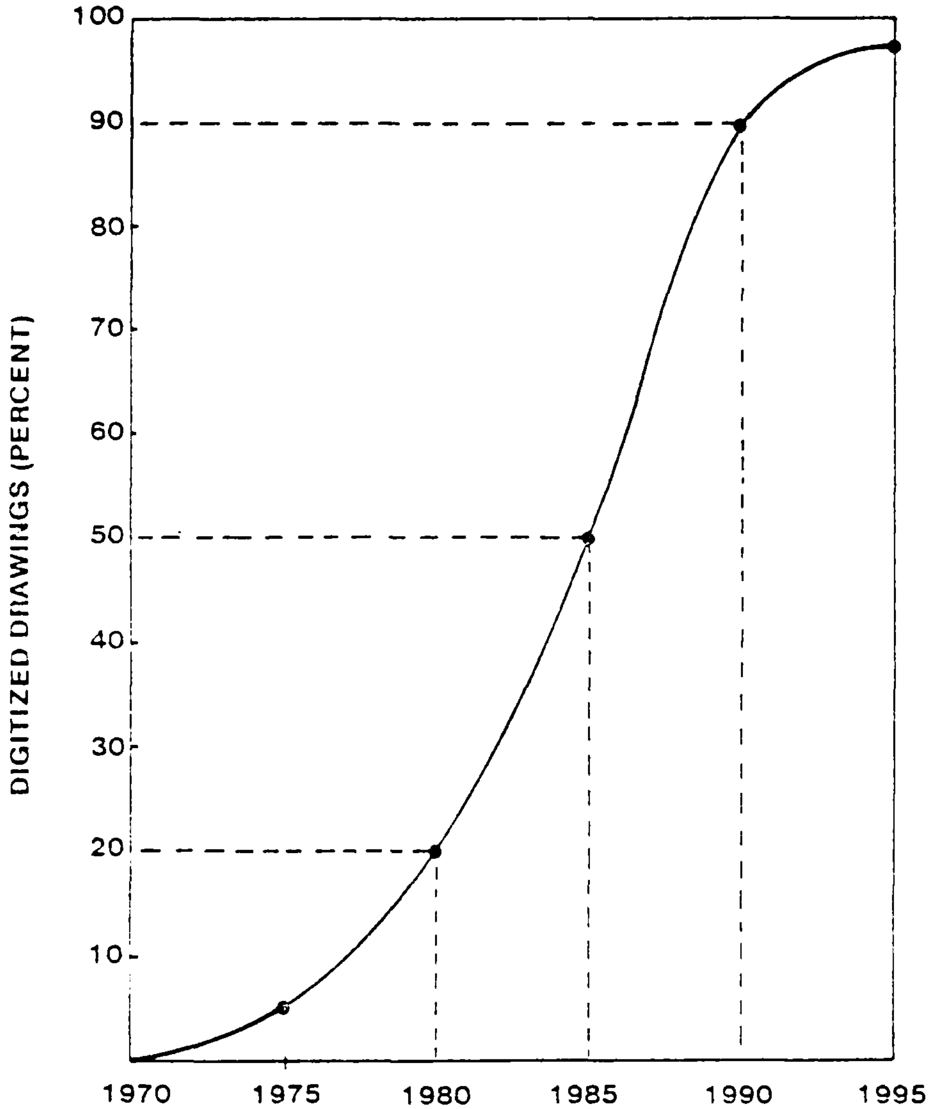
SUPPORT

AUTOMATED TEST EQUIPMENT (ATE) ANNUAL EXPENDITURES



SUPPORT

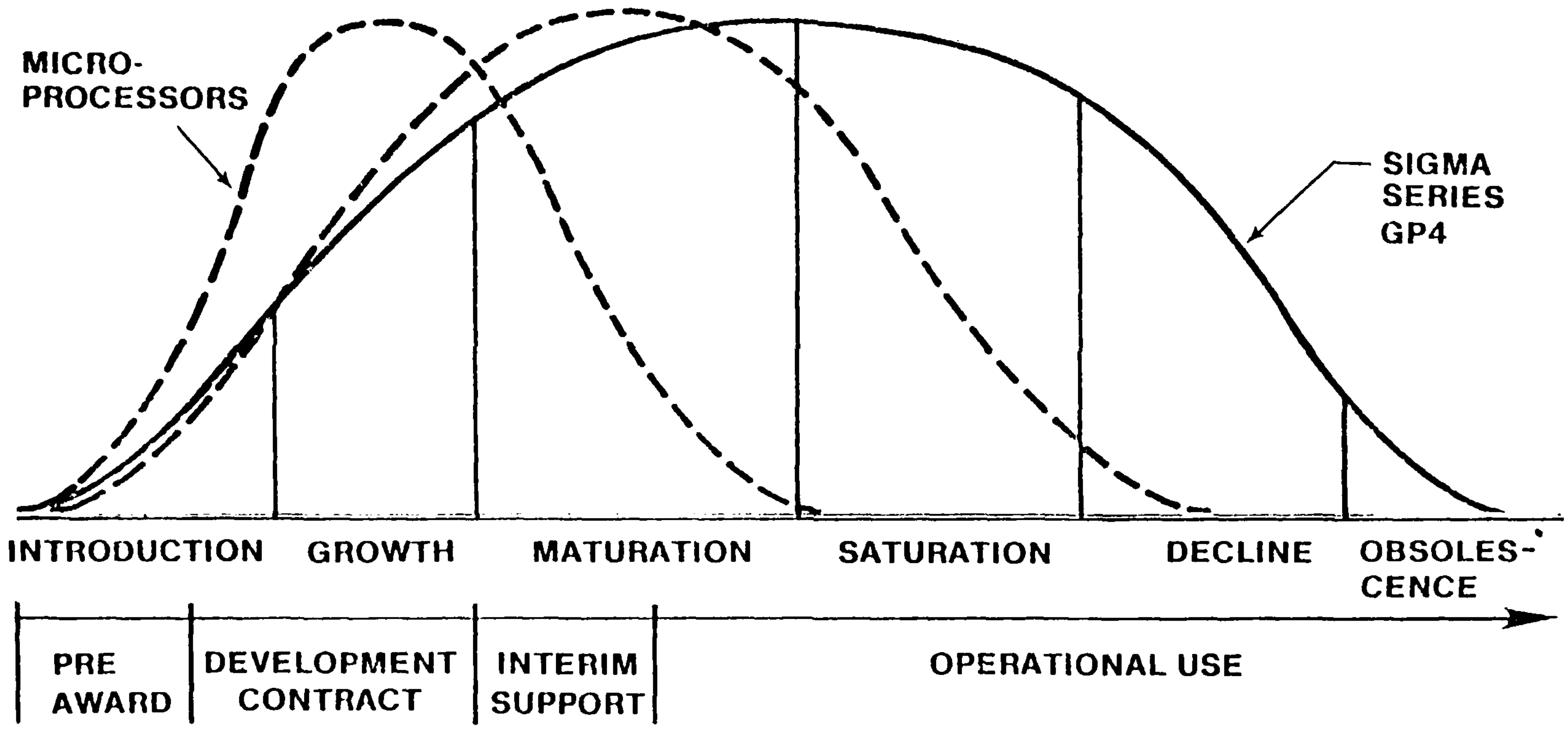
AUTOMATED DATA CAPABILITY PROJECTIONS



ABOVE FIGURES EXTRACTED FROM
NAVAL POST GRADUATE SCHOOL
(MONTEREY, CA) STUDY ON DIGITIZED DRAWINGS

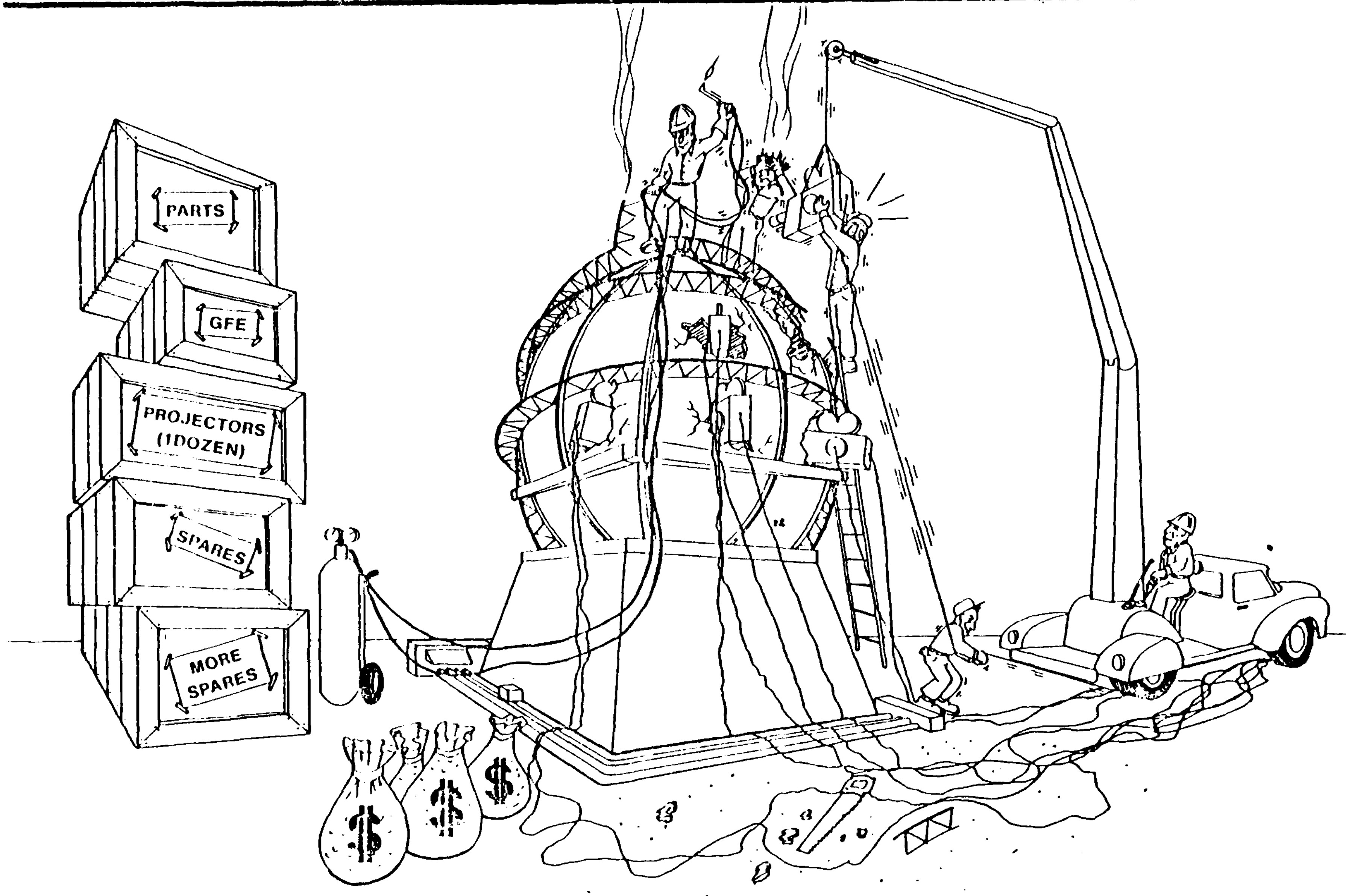
SUPPORT

IMPACT OF TECHNOLOGICAL CHANGE ON LOGISTIC SUPPORT



TECHNOLOGY

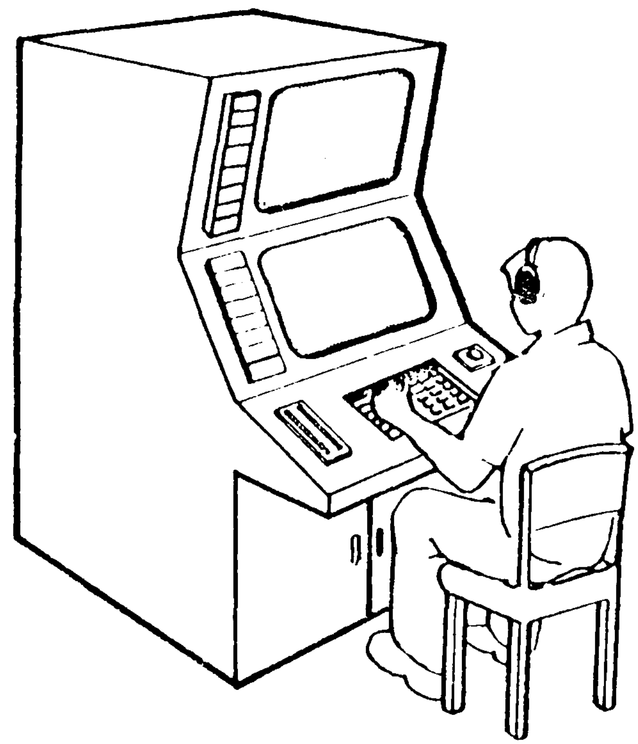
VISUAL CUL-DE-SAC



TECHNOLOGY

MAN-MACHINE INTERFACE

- MAINTENANCE TRAINERS
- INSTRUCTOR CONSOLE COMPLEXITY



TECHNOLOGY

LOW COST (C)
HIGH VOLUME (N)

C_n OR $_cN$

HIGH FIDELITY	GOOD STUDENT ACCESS
COMPREHENSIVE	HIGH RELIABILITY
ACCEPTANCE	NO SPECIALIZED INSTRUCTORS

This particular slide depicts some work that is going on with the 2E6 and the air combat maneuvering range in which we're trying to get some feeling for the defensiveness of the opponents and to provide performance measures and some indication as to when they're in the missile envelopes. It looks very attractive. It looks encouraging. The results are very tentative at the moment. But the real reason I put it up here is to try and solicit from you more interest in establishing performance measurement techniques in our trainers so that we can provide the proper feedback and make it a training device. The reason I'm so earnest about this is that I think that half the problem is technical, but the other half is acceptance. Nobody really wants performance measurement, it seems. If we don't establish this as a normal tool within our bag of tricks, by the time organic or embedded training comes on line, we will never have anything more than a tape recorder playing onboard ship. When the instructor is not there, an automated performance measurement is absolutely mandatory.

I think everybody who has been up here this morning and this afternoon has tried to say this one way or another and I guess I'm just the next guy to try it. It seems to me that it is inbred in our society that technology has to be paramount and that this permeates all of our decisions, even if they are subconscious. As a result of that, we tend to precipitate towards the left hand side of this slide and end up with a very high fidelity trainer which is so comprehensive in its ability that it has very high acceptance, very high fidelity, and costs so much that you can only buy one of them. Now, that may be the right way to go, but I submit to you that at least, let's make a conscious decision that the other way was inferior. I don't think we do that. The other way, of course, is to buy a simpler device that doesn't address all of the training objectives, that is less expensive, is more reliable because it's simpler, it's more operable because it's simpler, and what you're really seeing here, I think, is the difference between the American philosophy and the Soviet and European philosophies. If we're going to make a decision like this, let's do it consciously. Candidly, I think that we're not going in the low cost direction is because the user - and I mean the real user, not the budgeteer, not the manager, not the guy who can see the big picture in Washington, but the guy who has to use the trainer, he doesn't want a low-cost device. He is not incentivised to buy something low cost because he doesn't get the money that's left over after he's bought the low-cost device. If you could incentivise him in some way, then perhaps he would be ready to look at some of these lower-cost alternatives.

One last appeal. At NTEC, every captain drives his own ship and we respond to individual PMs, sponsors, major claimants and in every case, it seems that the policy is different, the support posture is different, the color of the money is different. If we could only get together a few times to make the efficiencies of scale, it would make it a lot easier for guys like me. Thank you.

Mr. David P. Glenn

I'm going to talk to you today about something that's perhaps a little bit different than what you've been hearing all day long. I'm going to talk about research and development needs for air crew simulators. And what I'm going to really do is give you some highlights of the process that the Air Force began this year for the first time in simulators. It's a part of the vanguard process or vanguard analysis, which some of you may be familiar with. This is the advanced planning that we've instituted at Air Force Systems Command. This is the first year that simulators have been involved with this.

I don't intend to go through the total vanguard process. That would be too much, too involved, and would take too long. What I do intend to do today, however, is to talk to you about those shaded blocks which you see on the vu-graph. We're going to look at the assessment which was made this year of our current forces and see what development goals flow from that. Then we're going to jump over a great deal of this process and end up up there in the corner where we look at what our prioritized efforts should be for the future.

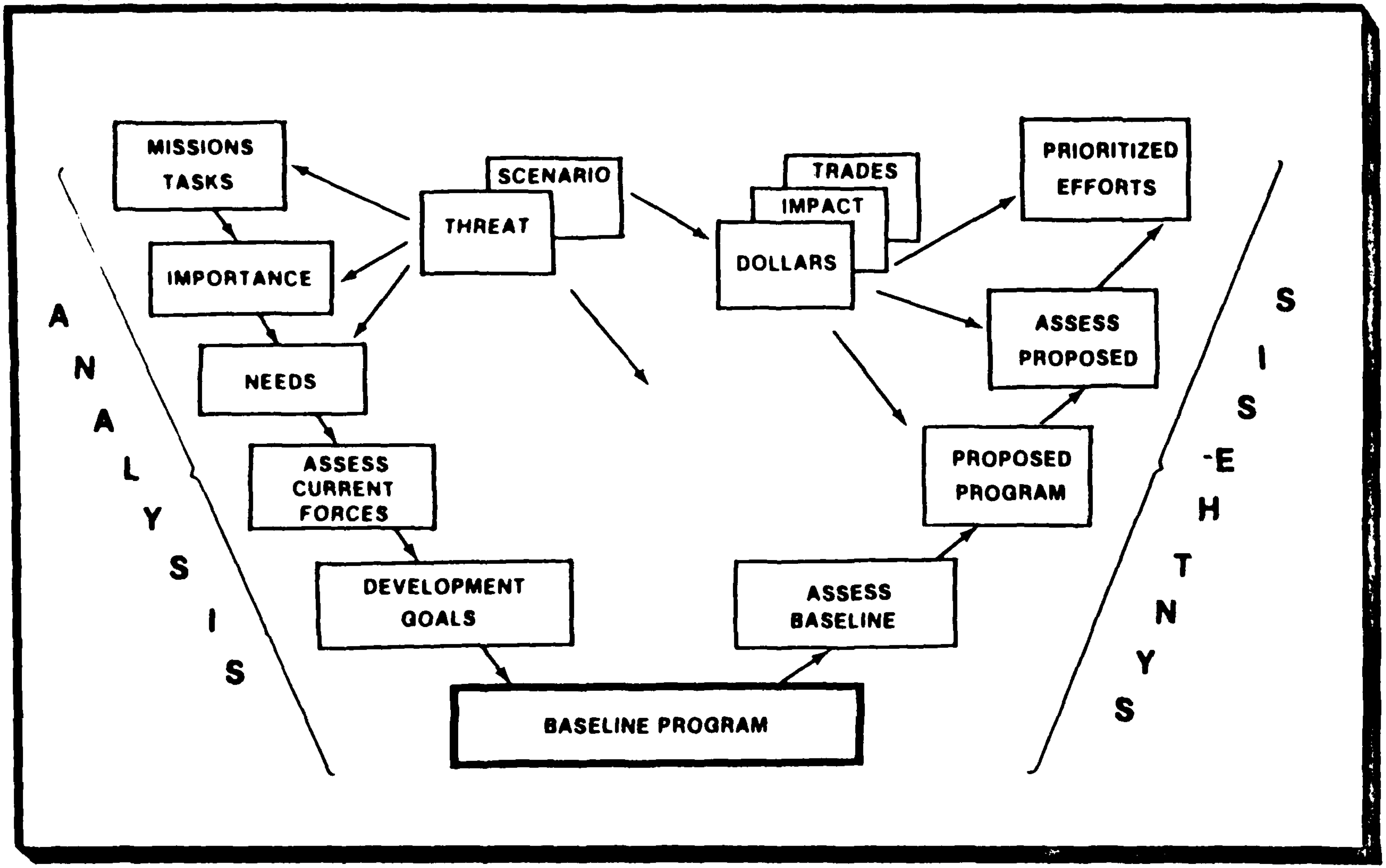
This is the approach that I will use. I will define for you a number of mission areas and then I will show you for each one of those mission areas two matrices, one which will plot tasks as a function of required aircraft simulators, and the second which will look at those same tasks as a function of the technology involved them.

These along the top are the mission areas which were looked at, from counter air and air-to-surface right out to Defense-wide management support. The simulators or aircraft systems associated with those are shown here. As you can see, they take in just about every aircraft in the Air Force inventory. I'm not going to talk any more about the Defense-wide management support because that really flows directly out of some of the other categories. That is, when you're talking about training people in T-37s and T-38s, that training is very similar to the tasks associated with flying the fighter-type aircraft.

These are the tasks that were looked at in this analysis. Taxi, take-off, climb, aerial refueling, and so forth, right on down to the bottom. The bottom one down here, simulator-unique elements, was unique to the simulator analysis. There are a number of things in the simulator business which are not necessarily a part of the other analyses that were formed for the Air Force. For instance, instructional systems, training effectiveness, data base, those things that create the environment, adaptive training, and so forth. We just created a new category to use for those particular elements.

We talked about by-missionary, we're going to look at tasks as a function of simulators, and now tasks as a function of the

"BATHTUB" CHART



ANALYSIS METHODOLOGY

BY MISSION AREA

TASKS vs REQUIRED
AIRCRAFT SIMULATORS

TASKS vs TECHNOLOGY

MISSION AREAS

COUNTER AIR AND AIR TO SURFACE	STRATEGIC OFFENSE	MOBILITY	DEFENSE SUPPRESSION	DEFENSE WIDE MGT & SUPPORT
F16	B52	C5	EF111A	T-38
F15	FB111	C141	F4G	T-37
A10	KC135	C130		NGT
F4	KC10	CH-3		TTB
A7	LRCA/B1	HH-53		
F111		HH-60(HX)		
F106		CX		

TASKS

- TAXI/TAKEOFF/CLIMB
- AERIAL REFUELING
- NAVIGATION
- PENETRATION/EGRESS
- WEAPON DELIVERY
- CARGO DELIVERY
- SUPPRESSION
- APPROACH/LANDING
- SIMULATOR UNIQUE ELEMENTS

PARTICULAR MISSION FUNCTION

SIMULATOR UNIQUE ELEMENTS

- INSTRUCTIONAL SYSTEMS
- TRAINING EFFECTIVENESS
- FORCE AND MOTION CUES
- DATA BASE
- COMPUTATIONAL SYSTEMS
- ADAPTIVE TRAINING

SIMULATION TECHNOLGY

- VISUAL
- RADAR
- ELECTRONIC WARFARE
- SENSORS (IR/LLTV)
- WEAPONS

technology areas. These are the technology areas which I will show you. We will use a color coding system, but there are a couple of assumptions that you should try to keep in mind as we look at the matrices. First of all, the color coding is based on the simulator being able to train a student on all tasks during a mission, and I emphasize all because if some task is missing, that color associated with it will not be green. We use a standard operational training concept and we have only done this analysis in terms of the simulators which we at the simulator. . . at ASD have been involved in and the technology that AFHRL has been involved in. Hopefully in the future, this analysis may be expanded to include some of the other efforts, those R&D efforts of you contractors as well as the work which is being done by Navy and Army and others.

This is the color code which you will see. The first, we color it green when the technology is shown to be capable of doing the task that we are talking about and when that technology has actually been implemented in an operational sense. In other words, we have an operational simulator somewhere that's in the training process. You'll see yellow if that technology may have been demonstrated in the laboratory but has not been implemented in the operational command, and finally, red just says that we can't do it, or at least it hasn't been demonstrated yet.

So much for the preliminaries. Let's get into the results. First of all, mission area, counter air, and air-to-surface. Along the top are the aircraft we're speaking of; along the side here, we look at the tasks to be accomplished. The first area, taxi to climb, everything looks pretty good. We can do that and in fact, we are doing that in operational trainers. Aerial refueling, that has been done in the laboratory. In most cases, the technology is there but it has not always been implemented in the field. There's a red there for the A-10 and I'll discuss that further with you in just a moment. Penetration and egress, weapon delivery - very difficult tasks to train in a simulator and, as you see there, we color them red. We'll discuss that on the next vu-graph. The others we have in hand, although we have not implemented it in the operational sense.

So why, then, were we coloring these things red from the technology standpoint? First of all, aerial refueling. You'll recall that that was red for the A-10 only. The reason it's red for the A-10 is that the refueling receptacle is right down in front of the pilot, and therefore he needs depth perception at close range to actually accomplish that task. That has not been done in a simulator, either in the lab or in the operational sense, to my knowledge.

Penetration and egress, you'll recall, along with weapon delivery and air-to-air and air-to-ground, was very red all the way across. That largely stems from the problems we have with visual systems. We need wide field, we need very high detail, we need high resolution. We have problems, therefore, with the technology of display systems as well as the data base which

ASSUMPTIONS

- COLOR CODING IS BASED ON SIMULATOR BEING ABLE TO TRAIN A STUDENT ON ALL TASKS DURING A MISSION.
- ASSESSMENT BASED ON A STANDARD OPERATIONAL TRAINING CONCEPT.
- ASSESSMENT LIMITED TO ASD AND AFHRL ACTIVITIES.

COLOR CODING

GREEN	· TECHNOLOGY CAPABLE OF PROVIDING SIMULATION SYSTEMS FOR TRAINING.
	· OPERATIONAL TRAINING DEVICE DELIVERED.
YELLOW	· TECHNOLOGY DEMONSTRATED TO BE CAPABLE OF PROVIDING SIMULATION SYSTEMS FOR TRAINING.
	· NO OPERATIONAL TRAINING DEVICE DELIVERED
RED	· TECHNOLOGY HAS NOT BEEN DEMONSTRATED TO BE CAPABLE OF PROVIDING SIMULATION SYSTEM FOR TRAINING.

CURRENT CAPABILITY ASSESSMENT
COUNTER - AIR AND AIR TO SURFACE

SIMULATORS

TASKS	F16	F15	A10	F4	A7	F111	F106
TAXI-TO-CLIMB	G	G	G	G	G	G	G
AERIAL REFUELING	Y	Y	R	Y	Y	Y	Y
PENETRATION/EGRESS	R	R	R	R	R	R	N/A
WEAPON DELIVERY	R	R	R	R	R	R	R
APPROACH/LANDING	Y	Y	Y	Y	Y	Y	Y
UNIQUE ELEMENTS	Y	Y	Y	Y	Y	Y	Y

CURRENT CAPABILITY ASSESSMENT COUNTER - AIR AND AIR TO SURFACE

SIMULATION TECHNOLOGY

TASKS	VISUAL	RADAR ★ CUR	RADAR ★ FUT	EW ★ CUR	EW ★ FUT	SENSORS ★ CUR	SENSORS ★ FUT	WEAPONS ★ CUR	WEAPONS ★ FUT
TAXI-TO-CLIMB	G	N/A		N/A		N/A		N/A	
AERIAL REFUELING	R	G	G	N/A		N/A		N/A	
PENETRATION/EGRESS	R	G	G	Y	Y	N/A		N/A	
WEAPON DELIVERY AIR-AIR	R	G	Y	Y	Y	R	R	Y	Y
WEAPON DELIVERY AIR-GROUND	R	G	R	Y	Y	R	R	R	R
APPROACH/LANDING	Y	N/A		N/A		N/A		N/A	

★ CURRENT & FUTURE REQUIREMENTS

CURRENT CAPABILITY ASSESSMENT
STRATEGIC OFFENSE

SIMULATION TECHNOLOGY

TASKS	VISUAL	RADAR ★		EW ★		SENSORS ★		WEAPONS ★	
		CUR	FUT	CUR	FUT	CUR	FUT	CUR	FUT
TAXI-TO-CLIMB	G	N/A		N/A		G	G	N/A	
AERIAL REFUELING TANKER	G	G	G	N/A		N/A		N/A	
AERIAL REFUELING RECEIVER	G	G	G	N/A		N/A		N/A	
NAVIGATION	Y	G	Y	N/A		Y	Y	N/A	
PENETRATION EGRESS	Y	G	Y	Y	Y	R	R	N/A	
WEAPON DELIVERY	Y	Y	Y	Y	Y	R	R	G	Y
APPROACH/LANDING	Y	G	G	N/A		N/A		N/A	

★ CURRENT AND FUTURE REQUIREMENTS

would support the CIG systems. You can go across - future radar, very high resolution radar, we see problems in right now. The sensors which I would define as those electro-optical sensors such as infra-red or low light level TV, those things are not in hand now as far as full simulation. The weapons we also have problems out there with in terms of simulating some of the missiles which we have to shoot, particularly the sensors associated with those missiles.

I'll move a little more rapidly now. I have no intention of asking you to absorb all the information on these vu-graphs, but I wanted you to be aware that they exist. In terms of strategic offense, you can see that we do a lot of things and do them fairly well. The red areas, I will emphasize again - penetration, egress, and weapon delivery and of course what would be true for the 52 would be likely true for the B-1. The problems there are largely associated again with electro-optical sensors that are needed for that penetration and egress mission for the 52s.

Looking at mobility, again things are fairly well in hand. It was pointed out to me by some of my friends that perhaps this taxi to climb should not be totally green because we haven't done a very good job of simulating their taxi mission for the large aircraft, which is very important to them.

Aerial refueling for the helicopters out there is a similar problem to that for the A-10. Close in and you need the depth perception at close range, which is not available from the dome-type system, for instance, or a TV system with an infinity type of image.

I think we've covered then, these areas of technology where we're having trouble with respect to mobility. Finally, I would point out to you the area of defense suppression and penetration and egress is again a problem. That's largely associated with limitations which we currently have in visual systems. So I think, then, that based on what I've shown you I think you can get some idea of the type of analysis that the Air Force has done for the technology areas.

This is a summary based, again, on just what is approved and underway now of what's happening in the Air Force in the technology area. It is somewhat distressing, and again that's just based on what we're doing now, to note that these red areas show no correction on out into the 90s, as we've plotted them here. However, of course you have not seen the total picture because the next step in the analysis process was to pick up the baseline program which included the future things and assess that, which would then show some improvement in the out years. I'm not going to do that for you at this point in time, but I do want to show you what came out at the end in terms of our prioritized efforts for the future. This is the list. It probably is not surprising to you to see that the visual area

CURRENT CAPABILITY ASSESSMENT
STRATEGIC OFFENSE

SIMULATORS

TASKS	B52	FB111	KC135	KC-10	LRCA/B1
TAXI-TO-CLIMB	G	G	G	G	G
AERIAL REFUELING TANKER	N/A	N/A	G	G	N/A
AERIAL REFUELING RECEIVER	G	G	N/A	G	G
NAVIGATION	G	G	G	G	Y
PENETRATION/EGRESS	R	Y	N/A	N/A	R
WEAPON DELIVERY	R	Y	N/A	N/A	R
APPROACH/LANDING	Y	Y	Y	Y	Y
UNIQUE ELEMENTS	Y	Y	Y	Y	Y

CURRENT CAPABILITY ASSESSMENT MOBILITY

	SIMULATORS					
TASKS	C5	C141	C130	CH-3	HH53	HH60(HX)
TAXI-TO-CLIMB	G	G	G	G	G	G
AERIAL REFUELING TANKER	N/A	N/A	Y	N/A	N/A	N/A
AERIAL REFUELING RECEIVER	Y	Y	N/A	R	R	R
NAVIGATION	Y	Y	Y	N/A	N/A	N/A
PENETRATION/EGRESS	N/A	N/A	Y	R	R	R
CARGO DELIVERY	G	G	Y	Y	Y	Y
APPROACH/LANDING	Y	Y	G	Y	Y	Y
UNIQUE ELEMENT	Y	Y	Y	Y	Y	Y

CURRENT CAPABILITY ASSESSMENT MOBILITY

SIMULATION TECHNOLOGY

TASKS	VISUAL	RADAR★		EW★		SENSORS★		WEAPONS★	
		CUR	FUT	CUR	FUT	CUR	FUT	CUR	FUT
TAXI-TO-CLIMB	G	N/A		N/A		N/A		N/A	
AERIAL REFUELING TANKER	Y	G	G	N/A		N/A		N/A	
AERIAL REFUELING RECEIVER	R	G	G	N/A		N/A		N/A	
NAVIGATION	Y	G	G	N/A		G	G	N/A	
PENETRATION/EGRESS	R	G	G	N/A		G	G	N/A	
CARGO DELIVERY	Y	G	G	N/A		Y	Y	N/A	
APPROACH/LANDING	Y	G	Y	N/A		N/A		N/A	

★ CURRENT AND FUTURE REQUIREMENTS

CURRENT CAPABILITY ASSESSMENT
DEFENSE SUPPRESSION

SIMULATION TECHNOLOGY

TASKS	VISUAL	RADAR★ CUR	RADAR★ FUT	EW★ CUR	EW★ FUT
TAXI-TO-CLIMB	G	N/A		N/A	
AERIAL REFUELING	Y	G	G	N/A	
PENETRATION/EGRESS	R	G	G	Y	Y
SUPPRESSION	Y	N/A		Y	Y
APPROACH/LANDING	Y	N/A		N/A	

★ CURRENT AND FUTURE REQUIREMENTS

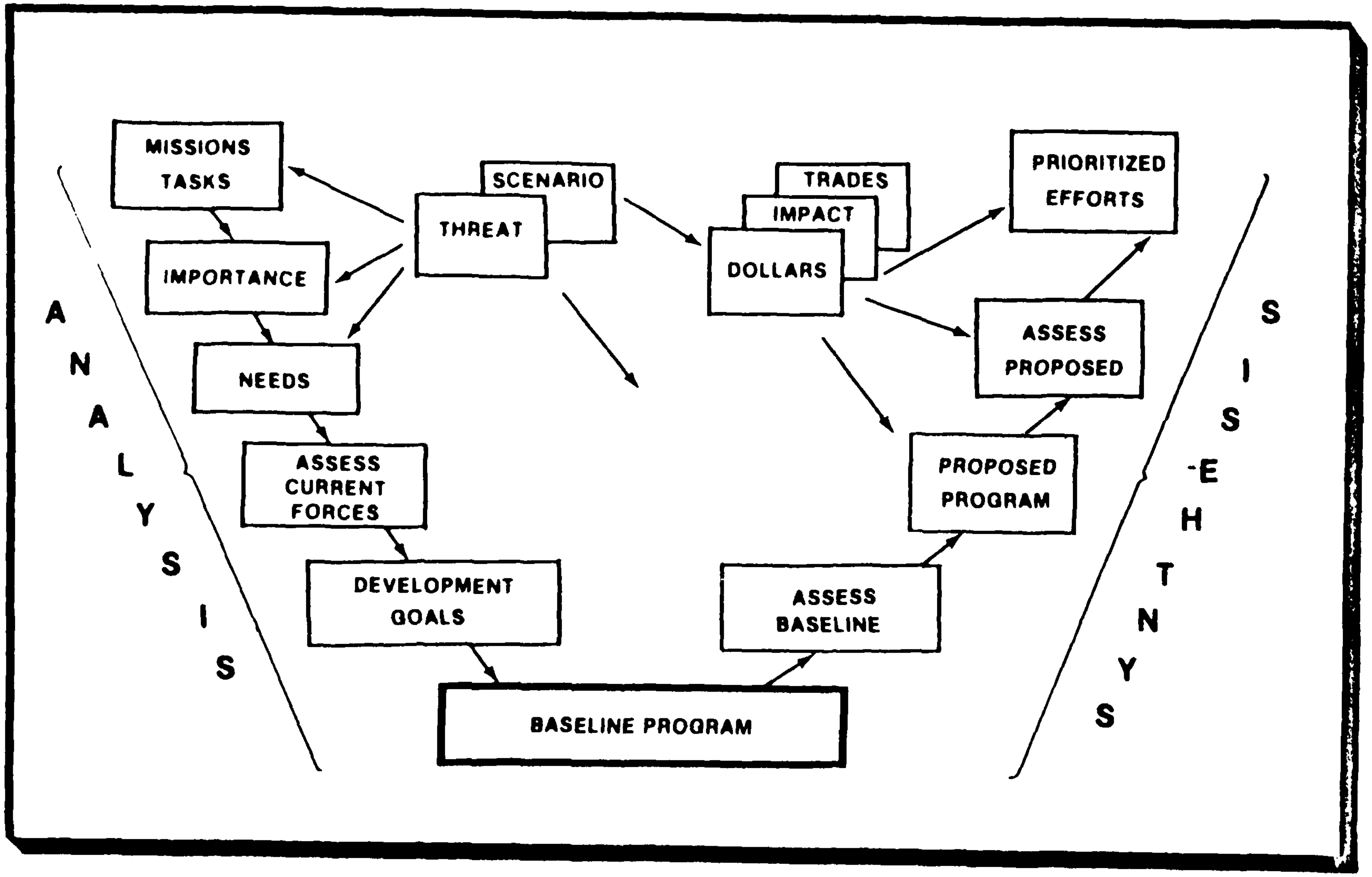
CURRENT CAPABILITY ASSESSMENT
DEFENSE SUPPRESSION

	SIMULATORS	
TASKS	EF-111A	F-4G
TAXI-TO-CLIMB	G	G
AERIAL REFUELING	Y	Y
PENETRATION/EGRESS	R	R
SUPPRESSION	Y	Y
APPROACH/LANDING	Y	Y
UNIQUE ELEMENTS	Y	Y

CURRENT ASSESSMENT

TASKS	82	83	84	85	86	87	88	89-93	94-98
TAXI-TO-CLIMB						G			
AERIAL REFUELING						R			
NAVIGATION						Y			
PENETRATION/EGRESS					R				
WEAPON DELIVERY					R				
SUPPRESSION					Y				
CARGO DELIVERY					Y				
APPROACH/LANDING					Y				
UNIQUE ELEMENTS					Y				

"BATHTUB" CHART



PRIORITIZED DEVELOPMENT GOALS

VISUAL - IMAGE GENERATION AND DISPLAY TECHNOLOGY (HIGH RESOLUTION - WIDE FOV)

UNIQUE ELEMENT - TRAINING EFFECTIVENESS OF SIMULATION

- CONCEPTUAL PHASE ANALYSIS

RADAR - TECHNIQUES FOR HIGH RESOLUTION SYSTEMS

SENSORS - TECHNIQUES FOR REALISTIC EO SIMULATION

UNIQUE ELEMENT - CUE REQUIREMENTS DATA

UNIQUE ELEMENT - PRODUCTION TECHNIQUES FOR LARGE AREAS

EW - TECHNIQUES FOR REALISTIC INTERACTIVE MODELING

UNIQUE ELEMENT - ADVANCE INSTRUCTIONAL FEATURES/ PERFORMANCE MEASUREMENTS

we ranked number one in terms of problems to the Air Force in the simulator area. The others flow down from there. Training effectiveness came in as number two. I might point out that it's pretty difficult to evaluate the training effectiveness until you can measure performance. So someone has pointed out that we have an error by having performance measurements down here, because they really should be at the top associated with training effectiveness.

If there's anything that I hope you'll walk out of here with relative to this very brief discussion, it's that apparently the visual problem is the biggest problem we have in the Air Force right now with regard to technology for the simulators. And I would say a close second for you human factors types has to do with training effectiveness and the measurement thereof. I would also ask you to keep in mind that this process will be implemented every year now by the Air Force with respect to simulators and simulator technology. So hopefully, that process is going to be married very closely to the POM work and other planning work which we do and will drive us towards solutions to these problems at an early date. Thank you.

LTC Bobby R. Adams

Good afternoon, ladies and gentlemen. As Colonel Campbell has already said, I'm Lt. Col. Adams, Chief of the Aviation Systems Division of PM TRADE. Colonel Campbell reminded me before I came up that we are running a little bit behind time and asked me if I could shorten my presentation. That really presented no problem at all. Since you've heard from General Miley, General Otis, General Meloy, General Starry, Colonel Hines - there's really not very much left that I could speak about. As a matter of fact, I was quite concerned about that earlier and I consulted with one of my friends from industry. I expressed my concern and the detail that I felt necessary, whereupon I was advised that I was faced now with a unique opportunity that I really should grasp. That was that I should suddenly take an opposing view and establish a name for myself. I gave that a great deal of thought and I realized that it's basically the same old story. When the Army really doesn't know what it wants, somebody in industry will offer a solution, usually at a very high cost.

There are a couple of things left out of my presentation that I think might be of benefit to you. They're brief and I trust that's because I'm the last speaker before happy hour. There are a couple of challenges, first to the Army, that I would like to state and then a couple of things to address to industry. For the Army, I feel that there is a real necessity at this point to commit, to apply necessary funding for any particular effort having to do with training, simulation, or whatever is in support of a major end item of equipment against which there is a determined schedule for delivery to the field.

That, of course, allows those of us in the training business to structure an acquisition strategy that does, in fact, relate to good business sense. Now, I give that challenge to the Army and I suspect that those of you in industry would endorse that in that that, too, would allow you the necessary planning that I know some of you that I've talked with would like to have in terms of planning your own work and effort.

A second area I believe the Army should address would be to establish the need or requirement and then minimize changes and what I'm relating to there is not changes throughout the life cycle, but specifically changes against a scheduled device delivery at some designated time. Of course, you've heard some pros and cons about that already today.

A third area, and somewhat tied into the second point, would be to anticipate changes and provide for those changes in terms of specific points or milestones along the life cycle process of an end item of equipment. Specifically, in the aviation business we know that the aircraft will continue to mature throughout its life cycle. I see absolutely no way that we'll be able to keep up with the changes unless we do have planned, if you will, technology advancements that we could plug in.

I think these are probably the more significant ones for the Army left after presentations today.

For industry, I see a very key area that we must ask you to work with us and determine how we might be able to accelerate this unwieldy life cycle program that you've heard discussed already. I don't know how many of you will be knocking on General Otis's door with the delivery of something within six years, but I certainly hope it's going to be a lot of you. I hope we can, in fact, come to grips with that problem and reduce that time of fielding needed equipment to the field.

The last point for you in industry would be to work again with us to assess, recognize that cost realism is here to stay. What I'm really relating to now is asking you to help us to identify those things that may not have a direct specific impact on training a task that we have identified. We do need your assistance there because many times we're guilty of simply adding on something because we think it adds a little bit more without a true analysis of that marginal return that you heard discussed today.

I hope these challenges, as Colonel Campbell said you would be getting this afternoon, will whet your appetite for questions later. Thank you.

Colonel Campbell

The guys are ready to answer any of your questions, or to have a little back-and-forth with you if that's what you want to do.

Question

(Cannot be understood)

Mr. Glenn

I guess I really can't answer that. Right now, the Air Force has a practically nonexistent program in maintenance trainers, although we do have that requirement. That's part of our charter. So it would be very easy to do right now, at least a baseline program on maintenance trainers. Should that area grow and expand, I'm quite sure that that would be included in the process, but I don't know of any plans for that right now.

Question

(Cannot be understood)

Colonel Campbell

That's very true and we are right now in the process of working with Colonel Childs out there at Leavenworth to define it. As a matter of fact, there was a conference out there this week with two of our folks and the Navy engineers went out to see just where they are in the field exercise, in the gaming process, the whole scope. They lined up in order of priority and I'm not at liberty to give you that, because they haven't finalized it, but it will be very quickly evident to everyone. We're talking in the bigger and the smaller arenas. I think that's what you're referring to. We're talking about the teaming; we're talking about the combat teams, the war games.

Dr. Harvey

There is a program in the Navy called File Group Interactive Gaming System, which is essentially self-explanatory. It's a large computer model which attempts to model the world and is directed specifically at the Flag rank for training of file groups. There is an initiative at the other end of the spectrum to teach war gaming in principle, which is called NAFTAG, which is a desk-top device which is expected to be produced in fairly large numbers to teach the principles of war gaming and there is yet another trainer called the Tactical Action Officer Trainer, which is currently under development at NUSC in San Diego.

Mr. Glenn

I guess I could say that there have been some thoughts in the R&D community about the possibility of tying simulators together in playing war games and so forth. That effort has not, to my knowledge, been funded, though, and it's just purely in the conceptual phase. Some of you probably are aware that

we did have thoughts of air-to-air type of combat, as well as air-to-ground and formation type work as part of our F-16 and F-15 simulators when the advanced visual system was included as a part of that program. That advanced visual system was cancelled, the so-called Tactical Combat Trainer, so at this point in time I know of nothing of that sort that is in the wind.

Colonel Campbell

Let me say one further thing. We have been attempting, because of all the interest out at Fort Lewis in the 9th Division, to get a real in with those folks and we're going to try to get a liaison officer out there so we can work, both from our standpoint at Fort Leavenworth and out there, in this area because they're doing a lot of that kind of work. We're also trying to get somebody down at NTEC and if I have to use the same guy for both, that's fine, too. In order to bridge that non-speaking gap that we have in the Army, where one man is talking one thing and another is talking another thing and we don't get together - we're trying to pull that together. Last year I said that was one of our aims, to talk in the community. We're doing a much better job, I think, and we're trying to make it even better.

Question

This question is for Dr. Harvey. Dr. Harvey, you addressed the general question of performance specifications. During many discussions I hear the term performance specifications, functional specifications, and it is not really clear to me, whether it was in the context of your own internal thinking and discussions, whether performance specifications and functional specifications represent one and the same thing. In other words, are they synonymous or are we talking about two different things? Could you perhaps clarify that?

Dr. Harvey

I'll try. Historically, what we've done is to specify in engineering terms what the configuration of the trainer should be. We get right down to the size of the TV. We stop short sometimes of its manufacturer. What I'm really talking about is trying to define what the performance is. Instead of defining its engineering configuration, defining what it's supposed to do, and allowing industry to come up with whatever configuration it thinks is proper in order to meet the need. In other words, instead of investing the engineering time up front in generating the spec, spend more engineering time in the evaluation of the proposals to determine which is the best solution to the question. Do I make myself clear?

Question

Dr. Harvey, you are clear on that, but I'm not sure whether I got my question across correctly. I really was not talking about what we call detail specifications, the engineering type specification; rather, the terminology functional specification has come into various discussions. I'm really not talking about the detailed engineering specifications, but the term functional specification, which has been used somewhat in the context of a performance specification. I was just wondering whether the two are really synonymous or not.

Dr. Harvey

As far as I'm concerned, in your explanation, they are.

Question

Dr. Harvey, addressing the issue of life cycle costs for trainers, do you see the implementation of ADA, especially common instructions and architectures and the common operating system among spenders, is that going to have an impact on the tendency of having hardware outdated before the trainer is fielded?

Dr. Harvey

I think it's coming, but I really can't speak to how it's going to influence the supportability. I really don't know how to answer the question. I think that ADA is going to be coming into our inventory. That's a fact, but how it's going to have an impact on us, I really don't know.

Question

Do you see that in requirements along the same timeframe as prime system development? That is, do you see the training devices specifying ADA in the same 83-84 timeframe as the Services requiring that for their prime systems?

Dr. Harvey

I doubt it. We're not doing an awful lot in it at the moment. I can't imagine that they would hit us that early. Absolutely can't see that.

Question

I have a question for David Glenn. How much validity has the vanguard analysis up at Headquarters Air Force and with the budgeteers? Do they see that as a solid technique for identifying needs or is it another one of these gimicks that they keep ignoring?

Mr. Glenn

I'm afraid I can't answer that, either, since I'm not from Systems Command. It's my understanding that if things are not in vanguard, it's just another hurdle they have to overcome. If they're there, I'm not sure that that gets them all that much further down the path, either. But that's from my very limited perspective, from back at Wright-Patterson. I'm sorry I can't help you.

Question

Colonel Campbell. I've been looking at these simulators out here and this is my first visit to the conference. I'm wondering if PM TRADE has anything going for these simulators on an integrated battlefield. I notice all these devices are nice and clear and you can see everything. Are we addressing the nuclear and chemical battlefield?

Colonel Campbell

Yes, in a very beginning way. It's one of those things that has come upon us lately. It's a little like the intelligence community. We've just gotten into this in the last year. As a matter of fact, we sat down and worked out some front-end analysis with the intelligence school - and I'm just using that as an example - it's the same timeframe and I got the report on that just last week. So, yes sir, we are. But there's not a lot that's been done in the requirements generation way from you all through ATSC to us. Maybe it's incumbent upon us to do a little bit more as a developer in looking into what's out there and my guys in the 6162 area try to do that. But with the interminable amount of projects that we do have, that's been a lagging area. I'll take full responsibility for anything done in the past and say we hope to do better.

Well, folks, not to belabor it, I really appreciate, number one, your attendance - number two, your attention - number three, your participation. You took some heavy shots today and I hope that as we break down into the smaller groups and we get a lot of the user-management-technical back-and-forth tomorrow, you'll be ready to stand up and shoot at us like the management guys, the executives did to me yesterday afternoon at the Executive Session. We have some licks coming, too, and we'll be ready to take them.

DECEMBER 1, 1981

SESSION VI: USER SESSION

ARMY USER PANEL

General Meloy

I'd like to introduce the panel members to you. On the far left is Brigadier General Parks Houser, the Commanding General of the 7th Army Training Center and sort of the G-3 Trainer for the 7th Army in Germany.

To my immediate left is Major General Dave Doyle, who is the DCSOPS of Forces Command at Fort McPherson. More recently, he was the Trainer Inspector for the Department of Army IG and has a wealth of background in the training device/training simulation arena.

To my immediate right is Colonel Bob Harrington, filling in for Brigadier General Bob Sunell from the Army Training Board. Bob was the last President of the Combat Arms Training Board and first President of the Army Training Board. He has been in this business for years and years.

To his right is Colonel Don Campbell, PM TRADE, as we call him here in Orlando.

We have a very experienced and knowledgeable panel for you and each member of the panel will have some preliminary remarks and then I hope we'll be able to open it up for questions. We welcome anything you might have after that.

Our first panel member to speak will be Dave Doyle.

Major General David Doyle

With this group of people, there isn't really much to address. We're looking at both our active component and our reserve component. We're having a whole new look at both our air and our ground systems. We could spend much of the morning talking about the training devices, simulation that we need, training systems - systems for the individual collective and sustainment programs. But this morning what I'd like to focus on is what we have just organized to focus on within Forces Command and I think it would be of interest to all of you.

We recently created a new ADCSOPS in our Deputy Chief of Staff for Operations within Forces Command, and he is going to be our ADCSOPS for Training. We've pulled everyone who has anything to do with training under his umbrella. And most importantly out of all of this, we have also pulled into that a new division, which will be our Training Management or our Range Management Division and it is really range modernization

and improvements that we're going to be looking at. That is what I'd like to do the focusing on.

(Due to technical difficulties, the remainder of General Doyle's presentation was not recorded.)

General Meloy

Thank you very much, Dave. We will next hear from Colonel Bob Harrington from the Army Training Board.

Colonel Harrington

As General Meloy commented earlier, I'm substituting for Brigadier General Bob Sunell and let me assure you that he would much rather be present down here in sunny Florida talking to this body about something is near and dear to his heart as opposed to facing a number of issues with the House Appropriations Committee or the Senate Appropriations Committee that he has to talk to today and tomorrow. He really wanted to attend this conference.

Secondly, I guess one thing that I've learned in the last two days, oddly enough, is that for a change, the Army and our sister services tend to have reached agreement on one thing. I have a sneaking suspicion that the cost of ammunition has gone up.

I'm not going to go through a lot of slides. In fact, all I want to do is reinforce the same statements that were made yesterday by General Otis, again this morning by General Doyle in his talk about the spiraling costs of ammunition. This slide happens to depict what some people think might be cute, but it really says that if you're going to shoot a tow missile, you'd better think in terms of firing one Honda Prelude downrange every time you fire. That's the cost you're talking about.

This chart depicts the same kinds of information on tank ammunition and how it is spiraling up, and again, it's just one more way of stating the obvious. Ultimately, as you can see in the out years, as you get up towards '85, for a 120mm gun the costs are up there knocking on the door of $1,200 per round.

The point that General Meloy made yesterday, the same thing on 5.56, as we get out towards '85, it's up to four times what it was not too long ago. This is one that depicts it in a little different manner, but it's the same issue, the same substance. This talks to battalion costs for one battalion to train on the 113 versus bringing on the new M-2 vehicle, the Bradley, and the column at the right indicates the Infantry

School's best estimate if, in fact, we have an up and going unit conduct of fire trainer.

I thought it might be interesting this morning to share with you a couple of other issues that the Army Training Support Center, as the TRADOC user representative, if you will, and the representative for our proponent schools, talk about some of the initiatives and issues that we're working on right now and they happen to be areas in which I think this body can provide a great deal of support and perhaps some of the answers that we're searching for.

In addition to what I think you are well aware of, and that is that the Training Support Center has a proponent responsibility for making the policy and the strategy and the direction for TRADOC for the development of training device requirements, that is, they're all processed through the ATSC and ultimately up to the Department of Army and, in fact, they actually manage the Training Device Requirements Review Committee, which puts it in the form that is ultimately forwarded up to General Meloy's shop. I think most of you are aware that that process is ongoing, but perhaps a few other initiatives you are not quite so familiar with.

In addition to that function, we do exercise the equivalent of a TRADOC systems manager component for non-systems devices, such as tactical engagement simulation. That's the whole arena that most of you are familiar with right now, known as MILES, the continuing DTOT-2 that was recently conducted on the air-ground and air defense engagement simulations, and one in which we are really seized and do not have the answer to, and perhaps someone in this audience may have some ideas on, and that is the indirect fire solution for engagement simulation. In all of my walks around in the displays yesterday, I didn't have anyone come up and tap me on the shoulder with any solutions to that one. Everyone seems to be seized with what I might argue might be the traditional or perhaps some of the easier issues. Someone needs to chew on that one a little bit.

In addition to that, we are also the TRADOC systems manager for the National Training Center. I don't mean to imply in any way that we are the operator of the National Training Center that is a FORSCOM activity, but we have a major function from the staff responsibility in the design.

Perhaps more importantly are some new and additional initiatives that occur at the Training Support Center that may or may not be too well known. Number one is that we feel that we try to act as a catalyst to try to seek the new, the unique, and the innovative ways to train. We do that through an organization called the Army Training Board, as General Meloy mentioned. Obviously, that's my old alma mater and I couldn't get through this without putting in a plug for it. But the main point is

that they are on the road constantly visiting the Army in the field and I would argue that the bulk of our orientation is on the Army in the field as opposed to institutional solutions to training problems, because I think most of us know, at least in this room, that in fact the bulk of the training that occurs in the Army occurs in the units of the Army. I'm not trying to denigrate the need for our institutions and schools, I'm just observing the obvious. So we have the Training Board constantly out visiting, seeking the new ideas.

. . . . for about a year, in fact it's in the second year right now and it is in the experimentation phase. I might add that Colonel Chris Conrad from our organization and the boss of that particular operation is here in the audience this morning and after I make a couple of comments, any of you who feel the need to, please feel free to climb all over Chris and talk to him a little bit about that program. But essentially, what the study is trying to do is get at the problem that General Doyle was alluding to a few minutes ago and that is the continuing reduction in availability of service rounds and searching for total strategies, and the concept that we're using is to look for strategies for battalions in the form of annual programs that maximize the use of the combination of full service ammunition, sub-caliber, and/or simulations. The systems that are being examined or considered for experimentation this year include the 81mm mortar, the 155 Howitzer, and the M-60 tank. A large-scale effort, a lot of ideas and concepts on how it ought to be done, and we appreciate getting any of those ideas, because regardless of where we go, this is an Army problem, it's not a TRADOC problem, and we're trying to address this issue in that form. We've been working with General Houser, we've been working with Forces Command General Doyle, and we've been working with the Department of the Army and also all of the test development community.

In addition to that initiative, we have one more recently formed organization, and it also links to the problems that were addressed a moment ago by General Doyle in terms of the range modernization and the need for it in the United States Army. I could stand up and talk for about four hours about meetings that I attended some four years ago in Atlanta, at which we identified the critical need to truly get on with the problem of range modernization in the United States Army - ranges, ammunition, and targets. It was identified then but the answer was, in terms of priorities, that we just couldn't afford to devote the manpower to it. I would argue that classically, you either pay me now or pay me later, and we're in the later phase right now and the price is kind of high. That's where we are right now.

The organization that we formed is called the DAART - we couldn't live without an acronym - the Directorate of Army Ammunition, Ranges, and Targets - and they are attempting to assist the Department of Army and all of the major commands

in the total management of the Army's range modernization program. We're talking about getting at the total picture that includes the design, the MCA construction aspects of it, the funding lines that need to be put in to support those issues - and that has to be accomplished - the target and scoring mechanisms to be placed upon those ranges, and ultimately the ammunition to be fired down those ranges. A large undertaking - an emotional one - but again, I am pleased and I think most of the people in the audience should be pleased that - I won't say for the first time, but it isn't always that all of the major commands are in synchronization in terms of the direction of their efforts and where they need to go to the future. I think that's a step in the right direction.

An example of the kinds of things I'm talking about is that recently, within the last 30 days, the TRADOC recognized the need on the part of the Forces Command, and on its own, reprogrammed some 50 percent of its own MCA money for FY84 to Forces Command's needs. The point is, I see the unity of kindred spirits trying to get at the problem in its totality, and I know that it's important that we need assistance from this body in terms of the materials and equipments that are placed on those ranges to assist us in solving those issues.

Lastly, for this morning's discussion, we have a number of initiatives that have ongoing, some of which you have seen graphically and depicted out in the demonstrations area, and they run the gamut all the way from the arcade technology, which perhaps has been somewhat over-publicized but at the same time it does offer some potential, all the way through a number of different applications of the video disk and microprocessor applications that probably are best depicted by the little tank gunnery part task trainer that you saw demonstrated by one of the corporations that is still on display.

I think the biggest thing that we're seized with right now in the process part of the program is one that was talked about yesterday and again today, and that's the time that it takes for the decision-making apparatus. We see a need to find improved methods of developmental risk analysis that will permit us the option of selecting the 70 percent or the "good enough" solution in order to optimize the utilization of the particular device. It briefs easy, but it's not an easy thing to do.

General Meloy

Thank you, Bob. We'll next hear from Brigadier General Parks Houser, the boss of all training in Europe.

Brigadier General Parks HOuser

Ladies and gentlemen, I'd like to begin by stating that first of all, this is my first assignment in the combat developments arena. I need to state that straight out because my

experience has been primarily in training. Training of all types of units, problems that soldiers have in accomplishing their training tasks, and the problems that leaders have in allocating the time that they have available to get the job done.

It's true that I'm located in Germany as the Commander of four major training areas, and I live at one of them, but I have a second job, also, and that is that I am the Assistant Deputy Chief of Staff for Operations for Training, there at USAEUR Headquarters. I travel back and forth between those two locations. My job there is a staff one, where I am concerned with the allocation of resources, training dollars, so that each of the various commands is getting their fair share. And that we're making wise purchases with those dollars.

The mission that I've got in both of those jobs is to do everything that I can to assist the Division Commanders and maintaining their combat readiness. This is a big job. General Otis spoke about that yesterday. He talked about the fact that the need was great. When he talked about the need, the one part that he did not talk about was the need because of the threat. You can feel very sensitive to the threat if you live where I do, that's about 30 miles from the Czech border. You have ample opportunity to get up there and see it, number one, but number two, to talk to all the local people around there, many of whom are refugees that came across at the end of the war. Those people know very well what it's like to live around the border. They know very well what it's like across the border. And they know what's going on over there. They know the intense preparation that is taking place. So we feel that need. And then all of us know, through all the various devices that have shown us, the quantity and the quality of the Soviet equipment and the amount of space that they have to train in and the amount of money allocated to them to do that. So that's the part of the need that General Otis didn't talk about, primarily because I know that he knew that you knew about that.

He talked about the need from another angle, though, and that was that we were changing so much - we were changing the doctrine, the way that we were going to fight this enemy, we were changing the equipment that we had coming into the inventory, and we were changing the organizational structure by which we would put it together. Now, any one of those changes causes us big headaches. Changing all three simultaneously is a big task - trying to figure out how to manage that modernization process and train everybody up to the point where they need to be.

So this is the part where General Otis then zinged into you, where he said there was a giant opportunity for you to participate with us as equal partners in this task, because we cannot get there alone. There's not enough space and time and dollars to do the job. We've got to have you and we've got

to have your best brains with us to accomplish this training task. I'll talk a little bit more about that in a minute. But from my point of view, I've got a little different situation. Some special needs and requirements and I'd like to go through the slides quickly to describe my physical environment and then I'll talk about a few other things and how they apply to you.

I want to talk a little bit about the training philosophy. Now, this is something that you probably all know, but this is the philosophy that is being articulated to all of the commanders and it's important that you realize from where we're coming. That second word says, "realistic." What I mean by realistic is that we're pulling the stops out. When you come to one of my ranges, you're not going to find a situation that looks like Fort Jackson, South Carolina, where basic trainees are going through. You're going to find much tougher, much more demanding training that also happens to be not near as safe as the situations that we have at Fort Jackson, South Carolina. So we're pushing that soldier as he's never been pushed before to be involved underneath and beside live fire.

Next I talk about "sustained." We know good and well the Soviet tactics, the fact that they're going to come at us in wave after wave after wave. We have to be prepared for a continuous operation. We've talked a lot about continuous operations over the years. It's been a FORSCOM requirement for years. But we don't do a lot about it. And knowing how to run continuously, hour after hour after hour, day after day, requires special tasks and we need special aids to assist us in that function, because we're not near staffed to the point where we ought to be to maintain that type of continuous operation. So we need a lot of help in . . . operations and in the operations of various fire control centers in order to do that.

Then I talk about "multi-echelon." This is a fact that we've got to have more than one type of training going on at the same time in each of the various echelons, like in a squad there are particular types of training going on. At the same time, leaders are doing something else at the company level. And at the same time, the battalion staff is doing something else again. The reason for that once again is that we don't have the time to accomplish all the essential functions that we have to do in the time allotted. This means things also to the training developer. The point was made several times in the last several days how we can't have single-purpose devices and devices that only can handle a couple of things. We have to have a broader range of activity and things that can be controlled and supervised at a lower level, not with a high-quality officer, say, supervising the training of some soldiers in a squad-level operation, because that officer is not going to be there. He's going to be somewhere else at a different level of training in a multi-echelon arena.

Then we talked about the combined arms training. Once again, that's picking up some of the points made before. We're makin' a big effort to train as combined arms teams. I'll talk about how I'm changing my ranges in a minute, but we're not looking at doing pure training. By "pure" I'm talking about only artillery training together, infantry only training together, armor only training together. We have to weld these into teams that know how to fight. We have a buzz word that we use a lot. We call it it "combat multiplier effect." That is, we know that any one unit that goes out there by itself is only as strong as the weapons it has, but to the extent that he knows how to use other stuff, like engineers to cover his barriers and intelligence resources to let him know what's coming in. To the extent that he can use all those things, he multiplies the effect of his own combat power. We do a lot of teaching them how to do that and that requires special devices and simulators, also.

Now, in that second bullet, I won't pick up on the air-land battle, because you've been hearing a lot about that. It's just a new doctrine about how we're going to fight with the Air Force and strike the enemy deeper than what we've been doing. But I do want to pick up on that word, "now" -- that last little word out there. The question is in Europe, how quick should we be ready to fight. The intelligence people will tell you different things, depending on what level you're at. It may very well be true that the National Military Command Center is going to tell the President seven days in advance when the war is going to start. But we don't think he's going to tell us. We think that they'll be debating the political ramifications of any early moves that we make and all types of things like that. So we know that a lot of that warning time will be eaten up in closed-door, top secret conferences. So the nearest we have figured it out of where we're going to be is that we have to be ready to respond in 48 hours. Forty-eight hours. That says a lot to the amount of sustainment training that we need to do, and why it is we need so many devices and where we need them positioned in order to maintain the skill. There are plenty of people in this room who have devices out there on that floor and the guy that owns the device can shoot it very well. But he'll also tell you that he practices almost every day to maintain that level of proficiency. If he takes a three-week vacation, when he comes back and gets on the machine again, he finds that his skill has dropped off substantially. So there are a lot of things we need to do in order to maintain the ability to take what we've got, both in people and in equipment, and go to war in 48 hours. I want to tell you, that's what we're training to do and that's what we're prepared to do, and I need a good bit of help from those of you in this room to make that mission possible for me as I start getting all this new equipment coming in.

This is the other chart I want to spend a little bit of time on. "GDP" stands for General Defense Plan, and you can figure out what that means. We have a plan, the plan describes the way

we're going to start the war, and we work on that plan a good bit, as you can well imagine. We've analyzed it in minute detail and from that analysis each unit determines what his battlefield missions are - the training objectives and what the plans are, what they have to do, how they're going to execute, and so forth. The point I want to make here is that the missions of all these units are different. If you were in a National Guard unit here in the United States, it might be that you've got a rather broad mission. Your mission is to be an artilleryman and to go over and perform an artillery function somewhere in Europe at D plus 100 days. That's entirely different from an artillery unit in Germany. Their mission is to go to war in 48 hours to a precise point and do a precise thing. That changes, depending on where you are, along the line because the geography is so different. In some places, it's open rolling plain; in some places it's dirty, chopped up hills, woods, visibility down to 100 meters. We also know the war is going to probably start in the winter when it's going to be very foggy. The number of hours of good visibility in the day will probably be no more than five. So we tailor our training. We tailor the tasks we work on and we tailor the things we evaluate. And so we have to have training aids and devices that are flexible; either they are using videos where we can go in and take pictures of different types of situations for each different type of unit, or the flexibility is built into the software so that we can vary the weapons' densities that are coming at us. The missions of the units that we have out there are very dependent - if you're in a tank unit that has a mission to be in a precise location and you have a good field to fire at in front of you, you're going to be engaging targets at the maximum range. But if you're in the counterattack force and your mission is to slip around to a crack in the seam of the line and attack the enemy on his flank, you're going to be hitting him at ranges of 200 meters and you're going to be driving 50 miles an hour and you're going to have more targets than you know what to do with. That's a different type of shooting. So we have to focus on great differences in our training tasks for each one of these type units. And we need a lot of flexibility in the equipment that we get in order to do this.

These are some of the training programs. Most of you who have been dealing with the Army are familiar with all of these. In each of these arenas I could talk and describe different opportunities for devices to assist us in doing our jobs quicker.

The point was made by General Starry about volume. How we cannot have a device that trains one man at one time. This is how many battalions I've got. All of these battalions come through my major training areas - not once; they all come twice and a lot of them come three times. In addition to that, I've got allied battalions that come through. So the bottom line is coming through my training areas I have 706 battalions a year

that we're managing coming through. And each one of them is there from two to three weeks. There's a host of things they have to do while they're there. This is a big problem for us to let them get all their work done. As ammunition shoots further, I've got safety problems and once again, opening enormous opportunities for simulation.

These are the training environments that I deal in. I've got a lot of training going on in garrison - I have to, because I've got an awful lot to do that has to be simulated. Each of those garrison facilities has a local training area nearby, but we're very limited in what we can get done there. The major training areas, or MTAs, we call them, are these three, plus we have a big school complex. And then we can get permission to train in the local area. We call that "maneuver rights." That's not easy and it's becoming harder and harder to do. I don't know that I blame the German farmer. When I was at Fort Riley, Kansas, and tried to get permission to train on the wide open wheat fields after they had harvested, the Kansas farmer told me to go jump in a lake. He wasn't going to let me train on his land. We expect the German to let us train on his land and he does, but we do a little damage and we have to pay for it. But as the political climate in Germany is changing, it's becoming more and more difficult for us to get out there and do that. There's a strong movement in the left wing of the SPD, the primary Socialist political party that's in power right now, and the conservationist movement is moving stronger and stronger. You've probably read a lot about that, to the extent that they're blocking the runway extension at the Frankfurt Airport. But that's just an indicator of how strong the conservationist movement is and how that's impacting on my ability to get out and train in the countryside.

These are some of the local training areas that I talked about. I've got 226 of them. This little pie chart shows you that most of them aren't much good.

These are the major training areas. Those major training areas would fit easily into Fort Hood, and that's where I train 706 battalions a year.

These are the things we've already talked about, not only me but a number of speakers before me. I put them up here again because I'm going to talk a little bit more about them. This, gentlemen, is where you come in and where, as partners, we have to work together. General Starry talked a lot about that yesterday and he talked about the need for these devices to be more cost effective, the need for us to be able to clearly identify to our OSD and Congressional staffers how we're going to trade off, how we're going to take this device and actually give up something for it. Either give up X number of tanks or give up X number of rounds of ammunition. You have to help me articulate that, and not only that, you've got to give me a device that does, in fact, allow me - with confidence - give

up that item or that ammunition, because I know this device will substitute.

I'm in the midst of a giant upgrade program on my major training areas. It starts in March of this year, when I'm rebuilding half of Grafenviess - putting in new types of ranges with new types of devices on them; trying to accommodate the new doctrine and the M-1 tank, precisely how it is that I'm going to use that vehicle and the tactics that we're going to employ to try to give it different types of targets. Thermal targetry - one of the points someone mentioned the other day. I'd like to tell you, we could not get anybody in industry to give us a thermal target. We've needed one for over a year and at great pressure, we finally found one manufacturer that produced a device that looks like it's going to work. But as we switch to thermal sights on our tanks, we needed a thermal target in the worst way and we didn't have one. I will not tell you what we have been using, because if I did, you'd laugh me out of the room. All right - I'll tell you. But don't report me. We have wooden targets. On the back of those wooden targets, we overlaced chicken wire, several layers of it. Where the wooden target lays down, we dug a hole. We built a charcoal fire inside that hole and every night we'd go out there and build 100 charcoal fires and stack it enough and hope it would last most of the night. When the target went down, the charcoal fire heated up the chicken wire and when the target came up, it was hot enough that we could see it. The problem is, all the wives complained because nobody could barbecue anymore. We were buying all the charcoal in the PX. And I had first run - I'd buy it as it came off the ship - by the ton. Obviously, this is not the best way to have a thermal target.

Here's the clincher. This slide has been shown in various ways all over, but basically what it says is that we have a turbulence problem. Soldiers come to Germany and they don't stay very long, then they go home. And while they're there, we're trying to keep them up to a certain proficiency level. When they get to go to the major training areas, that's great. They can go there and they can really do a good job of training. The problem is, that doesn't stay with them very long and shortly thereafter, because there is some type of home station training to pick them back up. The object is not to let them fall through that floor and to keep them up there, we need a lot of simulation devices to do that.

I want to just mention a couple of other things. The battalion commander, the guy who's doing the training, he's the manager. We say that his plate is overflowing and it is. We have more good things for him to do than he knows how to handle. We have exercises we want him to go on; we want him to be concerned with the education of his soldiers, not only military education but trying to get them a high school education. At the same time, he has a reduced manning level of the number of

NCOs that he's got over there and the number of officers that he's got. All these impact on him. The result of all that is that he is very, very busy trying to conduct his multi-echelon training and to manage everything. And so we need help and some good, sound devices.

I'm not involved in whether or not the M-2 infantry vehicle is built correctly. Those are big decisions taken back in the States. What I'm involved in is small training devices that don't cost so much, that enable us to do our job in Europe, be ready to fight quickly with what we've got. And I need help on that. I can tell you, there are certain ways I don't need help. Like, for instance, I'll give you one example, one example because it doesn't involve a U.S. manufacturer. I had a device that we were getting, made by a British firm, and the device cost $3,700 and I needed it badly. It was going to enable me to save some ammunition and they sold this device to us - actually, they sold it to the Armor School - we looked at it and decided to buy it. After I got it and started using it, a man came by to see me and said, "Oh, I forgot to tell you. This thing has to be calibrated every six months. I'll send you a calibration device - it costs $50,000." He didn't tell me that in the beginning, and not only that, the numbers that I had in mind that I wanted to buy, I couldn't have bought if I had to buy a $50,000 calibration device, also. I hadn't budgeted for that. So after a while, I heard about another manufacturer. This one was located in Switzerland. He had the same type of device. I went out and looked at it - it weighed one-third as much, it was one-third in size, it was very, very simple. It cost $2,000, but now I'm smarter. I asked him how to calibrate the device. He said, "Oh, it's very simple - you take an Allen wrench - it costs 23¢ - and you do it yourself, and here's how you do it." We brought one of them back, ran a quick test, and then told the British manufacturer, "Thank you very much, we don't care to do business with you anymore," and we switched to the Swiss.

What I'm saying is, I need help. This is a partnership deal between me and you. What I don't need is big, costly devices, as General Starry talked about. I need devices that are simple and can be used, and I need them quickly. I don't need them two years from now. The stuff that we need two years from now, I can get. What I need is stuff now.

I'll tell you one short war story. I want you to know that the American Army is healthy in Europe. I had the occasion recently to host a seminar between a German unit and an American unit. Everything went fine; nice weather, everything was great; we had a nice orderly presentation. The second day it was our turn and it poured rain all day. The morning wasn't so bad, because we were inside the classrooms getting the theory, but in the afternoon we went out and it was terrible. But the troops were all camouflaged up, they were in their foxholes.

As we went through the presentation and they saw the various stations, those soldiers came jumping out of those foxholes, sopping wet, covered with mud, had been there all day. But you couldn't tell it. As you looked at those guys, you could just tell that they were fired up. They explained precisely what they did and how it worked, and they had an intensity about them that was catching to the whole group. They went that way all afternoon, as we went from phase to phase to phase and more dynamic things happened. You can say, if you're a cynic that those guys were real hams. They practiced for that thing and they were putting on a great show and it didn't matter that it was pouring rain, they knew were going home to a hot shower pretty soon. But, that's not the way the German Army saw it. Those professionals that were there watching that, to a man, came up to me afterwards and said, privately and quietly, "You know, you just showed us a window through which we looked inside of an American battalion. We never knew that it was like that. We never knew they had that fire and that spirit. We never knew that they would respond to hardship in that way. We've been reading all this bad press about your soldiers. We had no idea they were like that and we were astounded, and we wish that our soldiers were like that." The German soldiers are draftees, it's a draftee Army, coming in for 17 months. You've heard a lot about them - they have some good equipment, but they don't have soldiers like we've got. We've got great soldiers that are filled with a spirit and with good leadership, I guarantee you they can produce. But we have big problems coming up that we've been talking about in the modernization and so forth, and we need devices to help us. I want you to know that I'm filled with that same spirit and so is my Command. We're about getting on with the job and being prepared to go to war in 48 hours, and what I need is help - people who can help me in the short term. So, those of you who are filled with that same spirit and you have something that can help me, then I'd like to talk with you. Those of you who have longer term, more costly projects, talk to my good friend down here, Bob Harrington, and he'll work on that project over a two-year period of time. But don't come see me if you fall in that category. Because we're too fired up and we're moving on with our mission. Thank you.

General Meloy

Thank you, Parks. Don Campbell is going to make just a few remarks and then we're going to open it up to some questions.

Colonel Campbell

I'm only going to take about five minutes because I know you want to fire some questions at the real users up here. I wondered why I was here.

We have had several initiatives since I've been down to PM TRADE, which we started 16 months ago, based on a study

we did with DARCOM and TRADOC. I shot this at you last year. As we talked about disciplining the system, we talked about bringing the community together. We've gotten a great deal of help from General Doyle when he was the IG; General Meloy, who is now our Godfather at DA; Bob Harrington and his boss, General Sunell, who talked to us daily - hourly - about the things we can do to pull the community together. We've got Lt Col Creighton Abrams. Not only the targets and range guys, but now the training device guy, right in General Meloy's shop. Gentlemen, the community is talking clearer. It's talking together. We've got Colonel Duke Schneider up here, who sits over on General Hauser's staff. We try to give him some assistance, some aid and comfort and a little advice every once in a while on how to follow up on some of the problems that he has - like, how do you get a maintenance contract written properly over there, so that when you buy these things you get a little support in the future and they don't get put in the warehouse.

So gentlemen, the community is coming together. TAKADA has got a liaison out there for us. We're trying to get one with the 9th Division, as I said yesterday, and we've got designated points of contact now at ARADCOM, TACOM, and other agencies. We're working the community. That's what I really wanted to bring to your attention because when the guys at FORSCOM sat down to figure out what they were going to do about their problem, Creighton Abrams and Don Campbell were sitting there, from the top and the bottom, to try to help work out their problems. So the community is pulling together and I think you'll see a more cohesive effort. Maybe we won't have so much of this, "Hey, I want, I want, I want."

This slide everybody hawked on yesterday - "what are we doing to improve the life cycle management model? what are we doing to get something out faster?" This slide is the same one I used last year, which says, "When you have a training device, you ought to get it out at OT-2, along with the system." Well, gentlemen, we all know how hard that is. It's a flat impossibility. I don't care who stands up on this stage and says it can be done, I'll take issue with them unless we do a lot of fixing early on, and we just aren't in the mood to fix. We just can't do it with the systems or the devices. So we're still trying to figure out where that device belongs out there. We figure with the big systems, since we only have a few of them coming out at a time anyhow, maybe we can be a year late. Maybe the . . . fire trainer is not going to be so bad when it gets out there a year late, a year-and-a-half late. We have to determine that within the Army and I think we're working toward it now. We have come up with a White Paper. We staffed it a lot through the rice bowls, and boy, did we get shot down. We said we want to get this thing done with a lot less OT, and we want to put it out here in about 12 months, like we did the fire finder training device at Fort Sill. Twelve months short of the cycle which we currently use, we got that thing in the field. We can do it if we break the rice bowls. We can also

do it if everybody in the audience does like General H user said - helps us figure ways to better analyze that product early on. It goes back to the cost and training effectiveness.

We do have the White Paper, as I said, going around DARCOM. It does these things and I think you all will recognize that it puts a lot of responsibility on the contractor and I think I've said a dozen times, gentlemen, we don't have an adversary relationship with you. We have one where we work together to get that device to the gentlemen up here.

This goes back to my comment about shortening the system. We've got to take the chops out of the system. We've got to take the people out of the system and get the decision-makers to make the decisions, the guys that really count, and quit having the nit-picking going on out there that you didn't dot your i or cross your t, or we're not going to have a device in the field.

With that, I'm going to quit, because I think you need to throw it at us.

General Meloy

Thank you, Don.

We've got almost 15 minutes before the schedule calls for a break. Ladies and gentlemen, we'd be very delighted to entertain any of your questions. We may not have the answers, but we'd like to hear them.

Question

What do you have in simulators for the electronic warfare side of that air-land battle?

General Meloy

As you all know, in many cases the real things knock off the actual air waves here in the States. In Europe the problem is even more pronounced from the standpoint of actually getting into the EW side of fighting. We don't have a good family of simulators for EW. We're still, I think, in the stone age. Example, somebody came in about a month ago, unsolicited, to my office to talk about some devices that were going to jam. It had a very healthy capability from the standpoint of the number of frequencies that could be jammed. Size and weight bothered me a little bit, but that's all it did. EW warfare is so much more than just going out and jamming a given net or a given frequency during the course of an operation. I'd say there's a very fruitful field. It's a major area for innovation.

Colonel Harrington

I think there are two requirements when we're looking at that EW environment. One, what it is that we can employ. There are some things that we can buy off the shelf right now and we are doing that in some areas. We can somewhat replicate the Soviet signals and they can do their job against our forces. What we also need, though, are devices that truly do replicate the Soviet signals so that we focus not only on our combat elements, who are trying to work through the Soviet equipment, but I think most importantly, so that we can also employ our own military intelligence people and their equipment, and they have the right signal coming to them. We don't have that right now.

Question

(Question cannot be understood)

General Meloy

Those devices do exist, but that's only the fundamental part of EW. When you get into more sophisticated jamming, particularly when you get into monitoring, that kind of thing, an intercept - first of all, it's a very highly classified equipment and trying to get a device into that gets to be tricky. I might add INSCOM is doing some work right now with NSA on that arena. But the larger issue of trying to actually take the totality of that battlefield and instead of just saying that we'll jam this frequency or jam that frequency, and go through a jam sequence for 20 minutes just to see if they are trained up to either avoid the jamming, work through the jamming, ignore it away, or what have you, that's where we stand. That's about the best we've got right now and I call that back at kindergarten level. The larger issue of the EW in totality, where you've got air - and I worry, really, about Army helicopter pilots and what EW's going to do to our flight control, what it's going to do to air space management as far as the Air Force is concerned, what it's going to do to the air defense artillery problem on the battlefield - all those things that get into the vertical dimension of EW, we don't know much about. We've written a lot of it in theory, but where do we go out and practice that and have the FAA not come after us with a big club.

Colonel Campbell

I talked with General Miley about this a little bit yesterday afternoon. We do have the first early analysis done with the intelligence folks on about 7 or 8 of their particular intercept devices and it's difficult to get in the arena, first of all, to get the classified talk flowing, but it is coming. It's very slow and I don't have any hope it's going to be here quickly. It's just scratching the bare surface.

General Meloy

I believe it was either General Starry or Dick Burpee from the Air Force yesterday that brought up the point of how to apply the EW environment into the simulation business, at least for the aviator. I think there's a great effort to do there.

Question

We who are out here in industry appreciate this conference for the kind of information we're getting in this particular discussion. I've been out here since about the end of February and I find that we in the community - you and we - are still very limited in the manner in which your requirements are conveyed to us in industry. Now, for those of us who could come to this conference, we've learned a lot. But it's essentially fundamental. I see the need for a more routine, regular distribution of Army requirements in terms which industry can understand and to which industry can put some of its own in-house efforts without government contracts. But I feel there is this different requirement that hasn't been discussed very much, but I'd like to hear some thought put to better ways to convey to industry in more understandable terms what industry can do to help the Army. These were all general statements this morning, but, for example, I know that there are papers within TRADOC that talk about the kinds of targets that the Army needs in the future. Well, unless an individual happens to stumble over that kind of paper, it is not widely available to industry. That's just one example. I just think we need to put our thoughts to better ways to communicate our needs to industry. I know PM TRADE does it in various ways, but unless the individual company in industry somehow or other gets the enlightenment and expends its funds to go after that type of understanding, it is not universally known.

General Meloy

I think you've got a very legitimate comment and I accept it in the light and spirit it was given and I think you're probably right. Without asking Don Campbell or Bob Harrington to amplify on it as far as what happened anciently, I'll simply take that as a note and assure you that it will be looked into very carefully. That's about the best I can promise you on that one right now, Jim.

Colonel Campbell

As you said, General Smith, we try to do this and we're not very good at it. We took that criticism in Executive Session the other day. But we do have a new document which is one of the things I spoke about, the TRADOC Comprehensive Plan. That will get you in the ballpark to get you down to our place or out to one of the schools. Because it's laid out by school and by Center. We also have a new five-year exploratory

development plan out of PM TRADE, the tech areas, and it's brand new. We've got an executive summary and we'll send it to anybody and everybody who wants one. I'm sorry I didn't say that before, but it's available and we'll get it to you.

General Meloy

How many of you here were aware, before Don Campbell started to talk, of this manual, of this document? I see five hands. That may be part of the problem. We have the material, we just aren't putting it out in the right channel.

Colonel Campbell

That's an ATSC document and the other one is mine. I just don't have the money to mail them to the world and I know I'm going to get inundated, so I'll have to get some more money, but we'll get them to you.

General Meloy

Send checks and money, friends. That's what we need for the mail.

General Houser

General Smith, I might just comment that what we're doing - because as I look at that document over there, it's too thick for me to handle. I don't have enough time to read it all. We're focusing on doing what you talked about and we're kind of decentralizing, because I'm responsible for writing the fielding plan for each of the new items of equipment. So we start with the item itself, and when it's coming, and then what we're supposed to be getting, and inevitably what we find out is that there are more items that we're supposed to get than the Army's going to be able to buy - they won't have enough money. So we're starting to host different little conferences to prioritize this. As an example, General Hoagland in Fifth Corps, about four days ago, hosted an artillery conference where we focused precisely onto what systems we had coming onboard, and when, and what devices in a priority way do we need most, and where were there any gaps between an item that we would like to have but what wasn't going to be fielded for three more years - what small type of a jerry-rigged gap could we live with in that timeframe. We're getting ready to get cranking on doing that for each of the major systems, let's say the artillery system or the Army aviation system, and put together a much smaller and more bite-sized list of priority type things that we can get quickly. It's like General Starry said yesterday, when we built those map boards down there at Rucker, okay, something replaced it - there's a better thing now that's cheaper than having that great, big building. But it filled an immediate requirement and that's what I'm looking for - a prioritized list of smaller things that will fill an immediate

requirement because I cannot wait. I'm fielding systems right now and I don't have the stuff I need to train on.

General Meloy

We're about out of time here. I would like to make one final comment to you, since this is the last time there will be any formal Army user panel, and that is I assure those of you here that training is indeed front burner in the U.S. Army, and I'd like to cite an example of that. About 60 days ago, when we started going through a second and third iteration - one of those that normally starts out on Friday and you had to have your answer in to the Secretary of Defense office by Monday morning - on budget decrements. There were some awfully painful and agonizing decisions made, as you can imagine, over the weekend. And I'm not talking about money in terms of millions of dollars, I'm talking about decisions in terms of billions of dollars that suddenly we had to start looking at alternatives and decrementing down. This was after we thought that that 83 budget was pretty solid, and we're still having those kinds of drills as we go through it. When you look at the requirements for forced modernization, and you look at that perspective from the eyes of the Chief of Staff, U.S. Army and the Secretary of the Army, big problems are involved and an urgency to get on with this business of trying to replace all the equipments that are 20 and 25 years old, but the technology that goes into that equipment is 30 and 35 years old in some cases. General Starry mentioned radios, for example, yesterday. So there is a driving sense of urgency within the Department of Army to get on with this, that we have been paying the piper too long and it's time we had to come back and pick it up. With all those decisions being made during these budget decrements and in spite of this sense of urgency to get on with forced modernization and equipment buy, we made a very basic decision at the very onset of the decrementing process and the Chief got all the major players together and said, "I want to make it loud and clear. Don't screw with training." We fenced it. And I was the one Program Manager, Program Director for money, walking around that building who didn't have his head down. I would get guys, of course, stopping me in the hall and giving me dirty looks, because nobody likes to have to play that game. It's a very tough decision process, as you can well appreciate. But we fenced it.

What I'm trying, I suppose, to say to you is that the climate in the Army today, from the standpoint of training, and all aspects of training - whether we're talking collective training, joint exercises, and the transportation costs attendant thereto, whether we're getting into the training device requirements, whether we're talking training ammunition - as high as that ammunition goes and as much as we need to decrement down because of the growing costs of ammunition, still we're able to plus it up in constant dollar terms each year. If you look out through the POM years, we're not going to

have as much, but we're putting more and more dollars into it. That's my message to you. We've got a golden environment in which to operate this partnership today and I think the players are more and more sensitive to that, and more and more attuned to it.

With that, I'll thank you very much for your attention. I've enjoyed it and I hope we're able to continue this sort of thing during the break.

Comment from the audience

General Meloy, on behalf of everybody here, we appreciate the outstanding panel that you've brought to us.

USMC USER PANEL

Colonel G. Shaver

I am Colonel Shaver. I have the Aviation Training Branch at Headquarters, Marine Corps. I will be the moderator for the panel and to kick it off, Major General Barker, Deputy Chief of Staff for Training, would like to make a few remarks, and then we'll get on with the remarks from the panel.

Major General Barker

My remarks are going to be very few because I want to give time to the panel here under the direction of Colonel Shaver, and as you can see, we have a very august panel here. We're going to get down to a little bit more plebeian, perhaps, than some of the other panels, because we're going to try to keep it down to the very user level and we would encourage your questions.

I would like to just reiterate to you just two points which we made yesterday. The first of those points is the fact that we really don't need that Cadillac for something that the Chevrolet will do for us. If the Chevrolet will get us from point A to point B, we don't need the Cadillac to get us from point A to point B. In other words, what I'm saying is let's try to take a look at the technology that we have, rather than going out into the future for the immediate requirements because we in the Marine Corps do not have the dollars, nor are we going to spend your money or our money - the tax payers' money - to buy something that is only going to give us a marginal increase when, in fact, something a little bit cheaper, something that's on the shelf today, will do the job for us and do it almost as well. That's not to say that we shouldn't look into new technology, because certainly we should. As our new

equipments are coming downstream, obviously we're going to have to have new technology to satisfy the training requirements of that technology that's coming in the future.

The second point that I would like to make is one that is very simple. Readiness is inextricably tied to training and I can only echo what was said by the Army panel. We in the Marine Corps can have as many Marines as we want in uniform, but if they're not properly trained, they're not going to be ready and that's the bottom line. We owe it to our young Americans who are in uniform to properly train them. That's where you and I, or you and the Marine Corps - your firms and the Marine Corps and the Department of Defense - can work together so that we can give our servicemen and servicewomen that are in uniform the best advantage when they go to war. That advantage is that they're better trained than their opponents, and thereby, they're going to survive and they're going to win.

So I ask you to help us to meet those needs that we have and I think a very cogent point was raised from the floor this morning during the Army's panel, and that is, we do a very poor job in articulating to you our needs. Many times what is very clear to us is not clear to you because we live with it day by day. So we would like to open these lines of communication and we encourage you at the conclusion of our panel presentation to ask questions and just because the panel will close at 12 o'clock so that you all can go to lunch does not mean that our doors are closed. Or if you think about something when you go back home to your companies, don't hesitate to pick up that phone and call us if you have questions because either ourselves or the people at NETC here at the Training Center can find those answers for you and can steer you in the directions that we, the Marine Corps, would like to have you go to assist us in resolving our training problems.

So without any further ado, I'm going to turn you over to Colonel Shaver.

<u>Colonel Shaver</u>

Thank you, General.

First, I'd like to introduce the panel to you. We've got some users, as you can see. We're of a much lower rank and we're down more closely to the nuts and bolts and I hope that's exactly what you want.

First, we have Lt Col Dick Thomas, who is the C.O. of the Second Maintenance Battalion at Camp Lejeune. We have Major Ed Valdez, who is the Range and Targets Officer at Twenty-Nine Palms, the Air Combat Ground Training Center. Then we have Major Bill Pruett, who is the Academic Officer, Motor Transport School. Next is Captain Mike Kurth, who is out at Yuma at our Marine Aviation Weapons and Tactics Squadron. We have Captain Jim Cook, who is at the Communications and Electronics School, also at Twenty-Nine Palms.

I'd like to make just a couple of comments here before we get started, and then I'll turn it over to the panel. What we'll do is have 5 or 10 minutes from each of the panel members and then we'll throw it open for questions from the field.

I've been the Aviation Training Officer and I work directly for General Barker at Headquarters, Marine Corps, for about 2-1/2 years now and I must admit that this is the first industry conference that I have attended. During this conference, as I wandered around out here on the floor and I listened to some of the other panels and the lectures and so forth, it's an eye-opener for me because I must admit, in all my ignorance up there at Headquarters, I sit in my little room wondering about all these things that you all have for us that I'm not aware of, and I think all too often that takes place with many of my counterparts. For me, I've learned a lot. The smart guy is the guy who recognizes how stupid he is. Well, I'm getting smart.

A couple of general observations - the Marine Corps also, like some of the other services, is recognizing the fact that you have to have a systems approach to training. One of the things that we have just recently done with General Barker's arrival at the Headquarters, Marine Corps, General Sardo who was formerly a one-star Director of Training at Headquarters, Marine Corps, has recently been replaced with General Barker, who is a two-star, and we've reorganized the Training Department at Headquarters, Marine Corps, into a two-star billet. One of the prime reasons that we did that was because we recognized that the way we are approaching training is rather antiquated and we need to get on to a systems approach to training. We need to have the trained people before we get the gear. All too often, we get the gear and then we try to figure out how we're going to train the people to maintain the gear. That just doesn't cut it.

From the time that I have been at Headquarters, Marine Corps and I look out at the next five or ten years, to me it looks like a wonderful opportunity for you all to capitalize on the training requirements of the Marine Corps. I think it's generally accepted at Headquarters, Marine Corps that our ground counterparts are not as far up on the steps, as far as training is concerned, as is the aviation side of the house in the Marine Corps. So there is a tremendous opportunity for simulation devices and so forth in the ground part to catch up to where we are on the aviation part. That's not saying that aviation does not need the training devices; by all means, we certainly do. When I look back - I've been in the flying business now for 25 years or so, and I look back and we in the Marine Corps are flying the same airplanes that we were flying 25 years ago. Very few new airplanes. Very few new aircraft systems are coming in. But now, in the next 10 years, almost the complete inventory of Marine aviation is going to be changing. We have the F-18 squadrons coming in at El Toro - the first three

squadrons are coming into El Toro on the first of July of 1982, and three months later the second one, and three months later the third one. So we'll have three F-18 squadrons at El Toro within the next year, when the F-4s go out of business at El Toro. So, of course, there are training requirements coming along for the new weapons system. We just recently stood up the C-853 Echo squadron at New River and we will be standing up our other West Coast training squadron at . . . on December 1st. And along with that comes new training requirements. The AV8B will take the place of all our A4 squadrons prior to the end of the decade and along with that comes many, many more training requirements. So you can see, in the next 10 years, both on the aviation and ground side there is tremendous opportunity if we can just get together and figure out the best way to do business.

When I listened to all of the catch words that have taken place here at the conference - I think there are four key words that keep popping up all the time. The first is "cost" - we don't have the bucks, or we don't have as much bucks as you want in order to produce it, so there has to be some compromise. Second is "timeliness" - it's got to be produced now, not two months down the road or two years down the road or whatever. Then that "maintainability" catch word keeps coming up - we have to be able to maintain the gear because we keep hearing that the black boxes are going to enable us to do it with fewer people. I'm telling you, it never works out to fewer people; it always works out to more bucks and more people and we have to turn that around. Lastly is "cooperation." We just have to cooperate more with each other in order to develop those training systems that we so desperately need.

I'd like to turn it over now to the panel and let them get down to some of the nuts and bolts. First is Lt Col Dick Thomas.

Lieutenant Colonel Richard Thomas

Thank you, Colonel. Good morning, ladies and gentlemen. Yesterday morning, the majority of us were privileged to hear the views of several highly respected individuals. These views expressed a need for a close working relationship between you, the industry, and we, the armed forces in the training arena. Of particular interest to this officer were those remarks centering around the need for increased assistance on your part so as to better enable the forces to maintain their equipment - present and future - and, in turn, to maintain the high state of readiness.

Currently, I am the Commanding Officer of the Maintenance Battalion, the mission of which is to perform intermediate maintenance - that is, third and fourth echelon maintenance support - on all ground equipment of the Marine Amphibious Force. The Marine Amphibious Force currently consists of a Marine

division, a Marine air wing, and the Fourth Service Support Group, all commodity areas - motor transport, engineer, ordnance, COMELEC and general supply are service to include component rebuild in all these commodity areas. When we speak to component rebuild, we include such items as radio components, starters, generators, fuel injection pumps, drive . . . such as transfer cases, transmissions, and engines. One example of the component rebuild is the rebuild of tank engines. At the intermediate level, we rebuild these engines at a cost of approximately $40,000 per copy. In this organization of approximately 1,100 personnel, our greatest resource, our greatest asset, as it is throughout the entire Marine Corps, is the individual young Marine, be it the Private or the Corporal or the young Second Lieutenant. To obtain the greatest utility from these young Marines and to prepare them for future service to Corps and to the country, we have an obligation to ensure that they are properly trained and supported with the tools of their trade. This training must be continuous and readily available. In general, the initial service school training or industry-provided maintenance training is adequate. Additional follow-on schooling is also adequate. The area of concern for this officer and to many others within the Marine Corps in the area of maintenance is the lack of in-the-shop training devices and aids needed for the reinforcement of the formal training received and coupled with the need for immediate on-the-spot assistance to personnel during the actual performance of their maintenance.

Today, a real deficiency exists in this area in that few, if any, training aids or devices are available in either our intermediate shops, which I am primarily concerned with, or at the organic level shops. Once initially trained, our young Marines must rely primarily on technical manuals or the experience of the shop chiefs or the shop officers. Unfortunately and all too often, the shop chiefs or the shop officers are not available to that young Marine at a particular moment in time when they're needed.

Also, in many cases, our shop chiefs are just returning from a three-year or four-year tour as a drill instructor or as a recruiter. They, themselves, are not up on the curve when it comes to the latest in the area of maintenance procedures, the new weapon systems that have come into the inventory, and the new test equipment as it has changed.

It is for these reasons that the majority of equipments reaching our level of the maintenance at the intermediate level are there as a result of inadequate preventive maintenance by the operator, operator inexperience during actual operation, or inadequate second echelon maintenance. Again, this is true in all commodity areas. It is quite evident to us that a real need exists. A need to be able to re-emphasize and reinforce formal training previously received. A need to keep our Marines

qualified as technicians and not just parts changers. We need to make available to those Marines on the shop floor during actual performance of assigned tasks those supportive aids of whatever nature that will enable him to quickly and correctly trouble-shoot a system without destroying the system, perform diagnostic testing, and to disassemble, repair, and assemble all equipments rapidly, correctly, and efficiently.

We see requirements for simulators, three-dimensional models, two-dimensional trouble-shooting boards, step-by-step guided diagnostic test systems using stand-alone computers, perhaps, and also with instructor programmable software. Further, the extensive use of video cassettes or sound-and-slide systems. We also greatly recognize the need for greater emphasis on front end training packages for the new weapon systems being acquired.

Gentlemen, I firmly believe that our young Marines of today are as good and as motivated as in the past, although we often hear differently. We, as Marine leaders, have an obligation to train them and to provide them with the necessary tools to accomplish their mission. Your assistance is greatly needed in this area and it is requested.

I thank you. I will be followed by Major Valdez.

Major Edward Valdez

Good morning. Placing things in perspective, I represent the Marine Corps Combat Center at 29 Palms, located in the lower Mojave Desert in California.

A couple of training concepts that we need to have cleared before I continue is the fact that you heard the Army this morning stating that due to the high cost of shells, ammunition, the vast portion of their training is going toward simulated combat experiences in the field and the word they use is "realistic." The Marine Corp's concept of realistic training at the Combat Center is live ordnance and maneuvers through live impact areas, so when you're trying to think of training devices that you could apply to the Combat Center, you're going to have to think of devices that can survive in a live exploding ordnance environment.

The Combat Center encompasses over a half million acres of land, roughly 932 square miles. Placing this in perspective, you can place all of the other Marine Corps bases in 29 Palms and still have about a third of the acreage remaining. In another comparison, 29 Palms Combat Center is about 8/10ths the size of Rhode Island.

Another point - General Barker mentioned that at many of the other bases, one of the big criterias for training is the encroachment of civilians or environmental restrictions that are

placed upon the bases. At 29 Palms, if you have ever been there or know what it's like, there really are no restrictions there. Our only restrictions are the desert, the sand, and the temperature - 117 degrees is normal for June and July.

The Combat Center also is in an area where there are no restrictions for the type and the amount of ordnance you can utilize, short of nuclear weapons. At the Combat Center, we have a C&E School; if some of you are familiar with the Seventh Marine Amphibious Brigade, which is associated with the near-term prepositioning ships that are anchored in Diego Garcia. There is also a Combined Arms Command there, which is represented by an infantry battalion, a tank battalion, and a reinforced artillery battalion. In particular, we are not a specific training area. We deal with combined arms training.

In 1974-1975, the Commandant of the Marine Corps placed upon the Combat Center the mission of conducting, coordinating, and evaluating the combined arms training of the Marine Corps, from which the combined arms exercises commenced in 1975. We run ten battalion-size exercises a year and tomorrow we're finishing the 47th. The program was designed to give the 27 regular Marine Corps battalions an opportunity to sharpen and put into effect the combined arms support doctrine that they learned at their bases at the Combat Center. This give the opportunity to each battalion once every three years of being able to rotate at the Combat Center. The exercises are realistic. The troops, the vehicles, the equipment actually maneuver in live impact areas. There is no simulated ordnance. All ordnance is live.

The Combat Center offers the battalion or the brigade commander to put into effect these practices in a realistic environment where they can see combat, they can hear combat, they can feel it and smell it, as opposed to simulates MILES training or other types of training devices. In addition to these live exercises, we are now incorporating the MILES system into another segment of our training, realizing that these two items may not be compatible on the same battlefield. We're devising, or trying to devise, a program where we do use simulated training, devices, preceding a live combined exercise. We feel that this is going to be a good combination.

With such a mission, and owing to the fact that environmental restrictions, civilian encroachment, 's here to stay, we were discussing last night that no matter what we try to do, it's going to get worse for bases that are in populated areas. So we're going to have to gear our thinking and our training and our devices to the only area that we really have where we can conduct unrestricted training and that's at 29 Palms.

Speaking of training devices that we could utilize, they're not unique to the Combat Center. They're generally required

by the entire Marine Corps, whether we're in Camp Lejeune, Camp Pendleton, or 29 Palms. What do we need? Non-communication, EW - something that can be placed forward of the battle area, supportable, relatively inexpensive, as opposed to a system that we utilize now which is called the DPT-1, which is relatively expensive for the dollars that we have, and very cumbersome. We need cheaper SAM simulators. The Smokey SAM right now is really not conducive to what we need. It's fired to our rear, where the attention of our training should be to our front.

Finally, we have a tank battalion. We rotate tank battalions at the Combat Center for annual training. They have tables that they need to run to. We don't have a comprehensive system that can fulfill the requirements of armor.

I will be followed by Major Bill Pruett.

Colonel Shaver

If you not familiar with the Smokey SAM, it's a little device which shoots up in the air so that the pilot or friendly forces can see a simulated SAM-1. The DPT-1 that he spoke about is . . . simulator that was devised by a Staff Sargeant using off-the shelf-equipment that we have been paying $3,000 TAD costs every time we want to use it. What we're looking for is some kind of a device similar to that we can get cheap, soon, and we can utilize at 29 Palms, or we can utilize it in any area where we have air-to-ground targets because the pilot gets lulled into a sense of security when he's making his constant runs on the same old target, the same old pass around there. What we're looking for is something like the DPT-1 that will simulate the occurrences in the cockpit.

Major William Pruett

I'm Major Bill Pruett and I guess the order of battle here is slowly moving down. I'll try to make this very quick and brief and to the point, and be specific as to what my requirements are.

I represent the Marine Corps Service Support Schools at Camp Lejeune, and by the nature of the beast, we are very technically oriented. We are service support oriented. We are the logisticians for the most part, in order to feed Major Valdez the operations people out there so they can, in fact, perform their missions and have those missions supported.

We are going back, reinventing the wheel, if you will. We do not have currently formal motor vehicle training. The raw recruit coming out of boot camp, his driver experience, be it a jeep to the biggest thing we have, motor transport wise, comes either on the job or in our field schools training schools, which are not set up in a formal manner and the ability to train is limited, primarily by the equipments that he has and

the experience and formal training of our instructors. The reinvention of the wheel is going to begin next April, in that the Commandant has directed that once again, after 12 years, we have a formal motor vehicle operators' school. We will be training some 1800 plus Marines on the East Coast, and a similar number of Marines on the West Coast at the satellite school at Camp Pendleton.

Requirements are very real here for simulation devices. None to my knowledge exist for operator simulators - tactical operator simulators - providing an environment in the tactical motor transport world to show fording. If you've seen any World War II movies, how many vehicles do you see left in the surf? They're there, they have a load of goods or Marines or whatever on them but they can't get ashore because they're dead in the water. The cost to the Marine Corps, if we go that way - which we intend to do until some device comes along - in order to train our Marines how to ford and stick them up in water up to their necks and let them get a real-world feel for what it's like trying to ford, every time we put a vehicle through that kind of environment requires one heck of a lot of maintenance that has to be done almost immediately when it comes out. So that incorporation into a simulator and operator simulator would be essential. Rough terrain driving, cross country in the snow and the sand - to give you some impact as to why it's there - as I say, training 1800 Marines at my location next year to do this, estimated fuel costs alone are somewhere around $70,000 and that's on a yearly basis and that's not counting inflation. Plus, repairs. And taking a basic Marine and putting him into a big vehicle that maybe the only thing he's ever driven is his daddy's car, is going to cost us a lot of money in repairs. So the field is wide open here and I solicit your companies, your thoughts, your ideas and support in providing the Marine Corps with that particular tool which can, in fact, save our vehicles, give our Marines the amount of hands-on training they need, be it real or simulated.

One other comment that is a concern of mine and at the schools, and also I think it's been touched on before, but I'll try to get down to the bare needs of what we need also in the area of software production. It's been stated numerous times that industry, the R&D folks, the contractors for the major end items that we're talking about, have got to get the bid early on so we'll get a full training package when it comes out. What, in essence, that means to us is that at the schools we do - and the Marine Corps is different from most other Services in that we do most all of our own task analyses and the entire writing of our POIs or putting the whole software package together. As we go about that, we've already got gear that's sitting out there, so our evolutions or our strategies and methodologies of instruction are constantly changing, but then there are no dollars left with which to go out and ask for a device that we need in order to make training more realistic. I think

our doors are opening and it's a question of simply asking the question, "What can I do - what courses do you have that you need things for?" I could talk about mechanics all day. The opportunity for you to take a look at a five-ton transmission and some way provide me with a device that is going to let me work that without completely tearing that transmission down and putting it back together at a tremendous cost - when you're talking mechanics training, we're training some 4,000 mechanics a year. Those things have to be done on the front end. Right now, what we need at the school are sound-on-slide capability. The existing sound-on-slide capability that we have, we have no maintenance for. When they wear out, they're gone. There's nothing on the shelf to replace them and the parts are slowly running out that we have. Something that we can use to do our own programming, to allow the student to work at his own pace, in something that is relatively inexpensive. But we're talking numbers, so it's still a good buy for someone that can produce that sort of gear for us. Something is simple, not complex, where the basic student can simply push a button and it stops, it goes forward or it comes back, and it talks back to him. With those types of things, the innovation that we have at the school, I think we can get on with business and continue what we have to do. We need your help.

Captain Michael Kurth

I'm a Marine Corps helicopter pilot and I've spent the last eight years in what we call the Fleet Marine Force - that's working with the guys that break anvils, things like that. I've been in every active air wing in the Marine Corps and I'm currently at MOTS-1. It's a squadron unique to the Marine Corps and, I think, unique to all services in the world. We have representatives from every squadron in the Marine Corps or from every type aircraft, whether they be rotary wing or fixed wing. We also have representatives from the Command and Control System. So we have an integrated squadron there and the sole mission in life is training. We spend time twice a year with the Weapons and Tactics Instructors Course, which consists of presentation of academics and then a three to four week period of intensive flying of all the aircraft that we have in our inventory. We run that twice a year, the goal there being to produce a Weapons and Tactics Instructor who will go back to each squadron and provide the information which we've given them at the course and continually update for him to his squadron mates.

We also spend a lot of the time that we're not in the class, because that takes about eight weeks at a time for those twice-a-year periods, we spend the rest of the time on the road visiting the squadrons and flying with the squadrons. For example, last week I was in California at Camp Pendleton and I flew the whole week with the squadrons there. This weekend I'll be in New Orleans flying with a reserve squadron.

This brings me to an important point. We have kind of an unquantifiable quality in the Marine Corps, which is directly related to a number of things but there is no real way to measure it. It's the esprit we have in the Marine Corps and it is the job of guys like myself, young officers, NCOs, who work with the every-day Marine to encourage that and to maintain it. Probably one of the best ways to do that and to improve morale is by realistic training. That is something that we need from you. We need devices which are simple, easy to maintain, and things that make what the guys do real to them.

Major Valdez talked about the live firing at 29 Palms and I saw some eyebrows raised in the audience about how do you make targets or things that you can put on a live fire range that you could continue to use at a low cost. Let me just offer you a suggestion in that regard and I don't know how to go about doing it. Suppose you had an inflatable target and then you poured a plastic mold around it, like a Clorox bottle or a detergent bottle - pretty cheap thing but you could have the silhouette of any kind of target you wanted. I think it would be relatively cheap. You could place it on a live fire range and I think you would add some realism. In addition, I don't see that it's a big problem to put pyrotechnics that can be remotely discharged in conjunction with those things, so to add the smoke realism, the firing realism from those devices coming back at our people so that we can improve the simulated, if you will, combat environment. The Smokey SAM that was mentioned - for those of you who don't know what a SAM is, it's a surface-to-air missile - and those that we're very much concerned with and those that we find at the front line level, hand-held grail type or SA-9 type missiles, we need those kind of simulators which would give our aviators cues in their flying so they'll know they're in trouble, they know they shouldn't be there. The same holds true for AAA simulators, AAA being anti-aircraft fire weapons. They fire at high rates of fire. We have simulating devices which give us those bursts and a short flight in the air so that there's no danger to the air crew to cue them that they are in fact being threatened. It goes a long way towards improving their ability to react in a real situation.

I have a picture of the kind of EW threat emitter that the Colonel spoke of, designed by a Marine Staff Sargeant, and while it's not as portable as it could be, it's portable. All that thing does is simulate or produce a radar signal which shows up in the cockpit on a piece of rod gear, cues the pilot to the fact that he is being tracked by radar, whether it be an acquisition or a search radar. Low cost, simple devices like that allow you to train at the unit level, the squadron level at the base you're at, and then when you get into the integrated combined operations, it's not a new thing. Or when you go to the EW range, of which there are very few in this country and are very expensive to run, when the squadron gets to that point they deploy and they work the EW range, they'll have already had

some basic training so that much of the learning curve is already accomplished and they'll be there with the full, real array.

There was a little bit mentioned about thermal imaging the other day, about how you take a silhouette and with something similar to an electric blanket, make it thermally significant at night for forward looking infra-red detection devices. Those are the kinds of things that we need. In addition, we need some cheap targets which have some radar significance to them and I don't know how to go about doing that, but if they're cheap and they can be used on both live and no-drop ranges, they'd be very worthwhile training devices.

One other area that helicopter pilots particularly get involved with is the use of night vision devices. I don't know how many of you are familiar with what we call night vision goggles, but they provide us with a lot of good training. What is really required, though, are low-cost filters for these goggles, which are of variable density which allow you to adjust the ambient light levels so that much of the training we are forced to do at night we can do in the daytime simply by using filters. It's much safer to train that way. It's not a direct substitute for night training, but it is sufficient to keep a guy proficient and allows him to train to emergency procedures and a lot of other things in a much safer manner than he could do at night.

Another area, at least for aviators, that is of importance is the application and the technology that's available in hand-held calculators and those kinds of things for the information performance data that's available to an aviator out of what we call our NATOPS manuals. They list all the performance parameters under given conditions. They have to do with the gross weight, fuel burn, load limitations, those kinds of things. It seems to me that those things could be very simply put on a chip and entered into a computer, very much like some of the flight computers that are available commercially for civilian flying that would make things much easier for the pilots, especially if they're out in the field. As an example, suppose a helicopter pilot is out to pick something up, when he gets there it was an entirely different load than he was briefed, so now he has to go about ensuring that his weight and balance is correct quickly. Instead of going through a mass of charts on several different pages, it would seem to me to be a simple thing to have a small computer, he could punch the data in, and he could have a simple answer to his CG problems, his power available, and all those other things which right now he basically gets out of his mind.

I don't want to hit this one too hard because I don't know exactly what to do about it, but there are some areas of war gaming that can be used at the squadron level, I think at the basic levels, whether they be manual or computer-generated, which I think have some application.

Finally, the last thing I want to talk about is target scoring. There has been a lot said about the MILES and I think it's a great system. However, when you apply it to aviation, you run into some very real problems. When you train with a system like that which simply makes use of the laser, you basically have point of aim, point of impact or line of sight. We all know that there's a considerable amount of ballistic drop and a considerable amount of parameters that go into the delivery of ordnance from an aircraft. You cannot simulate the delivery of ordnance very well with something like a laser. It's a nice idea, but it may be the wrong way to go to train. If that idea gets sold, it will lull guys into a false sense of security because their target lead and everything else will not be realistic at all.

That's about all I have to say this morning, and I'll turn it over to Captain Cook, who is also out at 29 Palms.

Captain James Cook

Good morning. My name is Jim Cook. I'm the Course Development Officer for Marine Corps Communications and Electronics Schools.

As the title suggests, we're in charge of making sure that the anvil breakers in the Marine Corps are capable of talking to each other. As Major Valdez stated earlier, Marine Corps Communications and Electronics Schools . . . . at the Marine Corps Air Ground Combat Center. We're the largest formal school in the Marine Corps and have been assigned the responsibility by the Commandant of training personnel, both operator and maintenance personnel, in the fields of communications and electronics. To this end, we conduct some 48 courses of instruction for 8,000 students each year. Now, our normal student load was approximately 2,000 students per day, but as of January we expect that to increase to approximately 3,500 students per day. To meet that challenge of training those students, we're looking for more and better ways of training.

Some of the problems we have of producing qualified personnel to operate and maintain communications and electronic equipment in the Marine Corps are the fact that despite over 75 percent of the Marines who are acquired every day are high school graduates, many of them have decreasing math and verbal skills. This is not to say that the individuals we're acquiring are dumb; it's simply a fact that the education that they've gone through has not trained them in math and verbal skills that are necessary for them to take high tech courses.

When you combine this with the increasing sophistication of the equipment which is being fielded in the field of communications and electronics, and also with the competition for qualified personnel because of the increased complexity in avionics and other fields in the Marine Corps, you see that there's quite a challenge to find qualified personnel.

When we add to that the increased training costs that we realize every day - and a simple example of this is that to train a radar repairman, we may have that student under instruction in excess of two years before he's qualified to go out to the Fleet to repair radar - we see that it becomes quite a challenge. And with the increasing equipment costs - for instance, a TPS-59 radar which is being delivered to the Marine Corps costs approximately $10 million per copy - you see that we are unable to procure large numbers of these systems for use in the training environment.

The Marine Corps has decided that the alternatives that are available to us at the School and to the Marine Corps as a whole are mastery learning and individualized instruction.

I'd like to divert for a moment to explain exactly what mastery learning is in the Marine Corps. Through the Instructional Systems Development process, the ISD process which has been promulgated by the Marine Corps, we identify criteria which the individual must accomplish in the field, as far as repairing equipment, operating equipment, and so forth. Once we have identified those criteria and made objectives for the student, we teach that student those objectives, ensuring his mastery of those objectives before he is allowed to proceed out. Methodologies of doing this include individualized instruction, allowing the student to move at his own pace, using the multi-media approach - programmed text, computer aid instruction, video tapes video disks, and so forth - and the use of simulators. This is especially important because if the students don't accomplish or don't master the objectives on the first go-through, then it's a requirement that we remediate that student. In individualized instruction environment, there is no real significant problem with that because the student is moving at his own pace. When you're talking about training someone to repair a $10 million system, you have about four or five students in the class and it's a requirement that they proceed lock-step, simply because of the fact that you can't afford to have them at different stages. So you have to take the student who hasn't mastered the material in a six-hour class day and remediate him in two hours or during the evening to ensure that he stays up to speed with the other students in the class. The only other alternative is to drop him from that class, perhaps recycle him, and if you only teach two radar classes each year, that's not a very cost effective approach.

The other approach that we're utilizing is individualized instruction. One of the problems with individualized instruction is that in most cases it operates with either computer aided instruction or with programmed text or something of that nature. Unfortunately, in the Marine Corps, unlike the other branches of the Service, we do not have detachments which are designed specifically for the development of courseware. We have no trained courseware authors in the Marine Corps, nor do we have a system that is really developed for the training of courseware. This has

been identified as a significant problem, training people simply to write program text either for use in the school or for issuance to the Marine Corps to Fleet units.

Also, we don't have any software author training for personnel to do authoring on computer aided instruction systems or, for that matter, for almost any other computer program that we have. Development of individualized instruction in both courseware authoring and software authoring is something that is sorely needed by the Marine Corps.

Those are areas that essentially the Marine Corps is finding significant problems in - that and the requirement for simulation. Now, I could go into great detail telling you what radar systems we're implementing, what communications systems we're implementing and so forth, and saying that simulation would be desired in any of those, but rather than take up your time, I feel that by pointing out Major Marlan from Headquarters, Marine Corps has the information on this, you could probably contact him and get much more detailed information than I could provide you at this time. Thank you.

Colonel Shaver

We're open for questions. I might add that Captain Cook was trying to give you point of contact and I will give you point of contact. If there is any additional information that you want, I suggest you go through Major Marlan, who is sitting down here in the front row and will probably shoot me for giving you his telephone number, but if there are questions that we can't solve here or contacts that you all want to make at Headquarters, Marine Corps, I would suggest you go through him. That's Major Jeff Marlan and his number is 202-694-1551.

Question

(Question cannot be heard)

Captain Kurth

We'd like it as realistic as possible as far as the smoke trail, if there is one, from the particular missile that is being simulated. But again, there is the safety factor. In other words, there has to be a burn-out at a range which is visible to the pilot, yet there's no real probability that the thing will actually hit an aircraft or cause any damage.

Question

(Cannot be heard)

Captain Cook

The Marine Corps has a detachment at Landing Force Training Command, Pacific and Landing Force Training Command, Atlantic, which teaches instructional management systems. Part of that includes program course authoring. Unfcrtunately, it requires the assignment of a student to a course of instruction which is approximately four weeks long. When you have 3,000 students onboard and you have about 197 instructors available at any particular time, you don't have the luxury of assigning large numbers of them to a course for approximately four weeks. What we do need is some kind of program of individualized instruction and self-pace on how to write a program text and how to do courseware authoring.

Question

(Question cannot be heard)

Colonel Shaver

I don't want to say that because I think we're still looking at that. We are in the process of implementing MILES at 29 Palms, but right now the air-to-ground phase of that, I don't think we've done too much along that line, so that's still open. We're hoping it's going to work out.

Question

The gentleman earlier asked whether or not we were utilizing computer-assisted instruction or computer-managed instruction at any of our schools. I think maybe that deserves some clarification to industry. Do any of you gentlemen on the panel know of any computer-managed instruction or computer-assisted instruction or any learning carousels at any of the Marine Corps schools?

Captain Cook

29 Palms has a computer-assisted instruction, computer-managed instruction program functioning at this time. I believe the Field Engineer School is in the process of applying to Headquarters, Marine Corps to get such a system, also.

Question

Does it offer the capability for a student at one of your schools to go ahead and bring himself up to speed through a self-paced program? Do you have an individual learning carousel arrangement out there?

Captain Cook

What we do have at this time is we have acquired the ticket system from Hazeltine Corporation and are presently implementing

it. We are developing at this time computer-aided instruction for a Com Center operator's course which teaches, essentially, personnel to operate in a military communications center, dispatching messages and so forth. We've got an internal section to develop the courseware for that. The course itself has been individualized instruction for approximately the last year, and this is the first effort we've made to develop a CAI support for it. We are concurrently developing courseware to convert a ground radio repair course, which is a maintenance course designed to train individuals who are acquired into the system to repair radios which are utilized by ground forces. They are in the process of converting the material into self-paced information and after development of the courseware for the Com Center operator's course, we are going to turn to that course to develop the computer aided instruction for that.

Major Marlan

I'd like to add just a couple of real quick comments. Right now the Marine Corps is looking at a computer-managed instruction program, Marine Corps wide. We look at computer-assisted instruction as a media, as most of you realize, just one of many different media with which we can use to instruct our students at the various schools. The advent of computer-managed instruction to track students, perhaps training resources, the input and output of the students, their grades, when they got there and when they left, is something that we're looking very closely at to save time, to save manpower resources, and to save the students' time at the course. We're not sure how we're going to go and we're looking at the possibility of one major system with tentacles to each of our schools or independent systems at each of the schools or some combination of the various possibilities. This is an area that we will probably be going to industry for in the future, the not too far distant future, to perhaps offer some suggestions as far as stand-alone computers that have the software, development systems built in themselves so that a scheduling officer or a management officer at a particular school can continue to update the system.

Colonel Shaver

If there are no more questions, on behalf of the panel and myself, I would like to thank all of you for letting us present to you what we perceive is our needs. We will be available up here for individual questions if you want to come up after we secure here. If not, it looks like we're securing somewhat early for lunch. Thank you.

Mr. Merl

For several years, we've been having an Executive Committee Meeting, always parallel but quite separate from the remaining part of the conference. This year we're going to attempt to bring to your attention some of the key issues discussed during this year's committee meeting.

We've assembled a very competent and able panel for you. The moderator of the panel will be Colonel Don Campbell, who is the Project Manager for Training Devices at NTEC; Captain McHugh, U.S. Navy, Commander of NTEC; Colonel Redenbacher, U. S. Air Force, Deputy for Simulators; Colonel Castellana, U.S. Marine Corps Liaison Officer at NTEC; Mr. Bill Turner, President of Singer/Link; Mr. Bob Stephenson, Hughes Support Systems, Associated Division Manager, Test and Training Systems Division; Mr. Robert Johnson, President of Applimation; and Mr. Bill Eager of the Grumman Corporation.

Colonel Campbell

Just to give you a little background on where we came from on this thing, there have been a lot of requests for reports out or what did you do in the Executive Session, and sometimes I think some of the folks that participate in it would say, "Well, I'm not exactly sure." When the comments started coming in and we read the critique sheets last year, we said, let's see if we can't make this thing very short and sweet, but let's get something out of it, not realizing that it was a good football Sunday afternoon. But we did it and we stuck with it and the guys were really diligent and came well prepared. We sent out letters in September saying here are some topics that came up. How about preparing to discuss them. When folks came in, they were ready, and what I have asked are these four subjects that I'll read out as I introduce the speaker. The most learned speaker on the point - or maybe I should say the most vociferous speaker on the point - we took down and transcribed very faithfully, and Colonel Driscoll worked up the outlines and everybody has gone over them and we think we've got a good report out. The way I'd like to run it is the folks report out and then we have some comments on your perceptions of what went on or your perceptions of the points, because we've got some pretty controversial things here and some things that we'd like to try to institute in our dealings with you all on a day-to-day program basis. So it's up to you all to make this thing happen, as far as the back and forth, as I said yesterday afternoon. So without further ado, I'd like to turn this over first to Mr. Bill Turner from Singer. He's going to talk about four-step contracting.

Mr. William Turner

Before we get started, I'd like to clarify one thing. All this "learned people" and so forth - actually, I was number 11 in line that opened my big mouth and Don said, "You're on the

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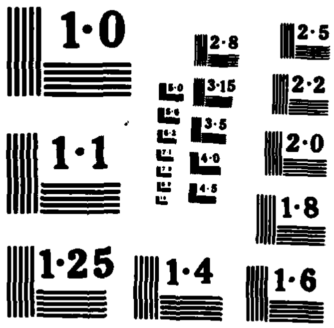
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panel." The subject that we went through was the four-step procurement process with a tack-on that really brought everybody to the forefront - and associated problems. Obviously, we came to the meeting with the idea in mind that we have problems.

Before getting into the problems and our recommendations, just some general observations. As far as the group, we did not feel that there was a great deal of experience on the four-step procurement process within the confines of the room, in that the Air Force in particular had only experienced or gone through one and that was the B-52 fly-off competition, and at NTEC, really the current initiatives are the first on the docket as far as use of the four-step. So coming from a point of looking at a process really not deeply experienced in it, but observing some problems as we are merging into the process. Generally, as an observation, it looks like the process - like any procurement process - eventually leads you to the desired procurement goals. None of them are without problems in getting to the end, but it looks like it certainly will achieve best value and essentially, one of the main goals of reducing technical leveling and achieving an eventual procurement action. It appears to be creating some problems, however. We tried to list the problems and I'll just run down through these. Number 1, and probably the one that was discussed at most length, is the excessive length of procurement cycle under the four-step procurement process. This is caused by a number of things, including the arms length position that the procurement activity has to take to preclude one of the objectives of the four-step, and that's eliminating technical leveling. But it does raise problems relative to an understanding of what's been communicated in the process. It establishes a number of barriers, and only opens one vehicle to removing the barrier of understanding or lack thereof, and that is written questions as a means of communication back and forth. These questions, historically, have gone on and on and on, drawing up a great amount of technical resource commitment by the bidders and translating into direct dollar expenditures which, again, appear to be more than the other forms of procurement action that were taken in the past.

Poor communication on high technology areas relating to the barrier that has been set up, and we all feel that that could work in both parties' favor - the bidder in terms of getting his point across and selling his proposal, and the buyer in terms of really understanding what's been offered and truly being able to make a competitive analysis, and probably what is of even more concern, what is the contract I bought after I get under contract.

Proposal preparation cycle in this four-step procurement activity was espoused as being too short. If the product which is the proposal is to be judged on its own with only these written communications as a vehicle to assess it, then the contractors all stated that we felt we needed more time and probably the reason for the overall stretch-out and more and more questions is the fact we tried to produce a product in too short a period of time, that is, the proposal.

It was also discussed that part of the problem is the administrative approval cycles within the Government, but they are also being matched by the administrative approval cycles within industry. We are all faced with bigger and bigger programs. We have to go to corporate cycles, and it's causing an overall slip-out in time.

Finally, and I don't know how this one would be attacked, the basic four-step is set up to eliminate those not qualified in the early stages of procurement so that you stop the flow of money for them and get on with the people who can do the job, and generally speaking, it appears as though that process does not occur. It's a continuation of those who are in the game until the final end.

Recommendations out of the group was a suggestion of using three-step or a modified four-step to save time and money, which of course would mean a waiver within the current system, but the key reason for doing this would be some way of opening up a dialogue during the procurement process, particularly in our high technology endeavors. Second, if a contractor is disqualified, let him know early. It saves him time and money and certainly saves the Government money in terms of overhead.

Very critical is the clear statement of requirements so that the product or the proposal is better, to cut down the myriad of questions and the lengthy time of evaluation. It was also felt as a recommendation that even a greater use of the draft RFP process should be continued as a way of defining requirements - both technical and the contract portion of the RFP - so that there would be an opportunity for each contractor that was going to be given the opportunity to bid to respond, not only in writing, which is done now, but hopefully in a chance of a one-on-one with the contracting agency to get first-hand some of the insight as the contractor sees it.

Again, give more time for proposal preparation - a minimum of 60 days was recommended, with another 30 to 45 days for the ultimate cost on a major procurement.

Limit questions to the important questions only, and hopefully, if we had a better product to submit maybe that would cut down the cost of iteration.

And very important, and an area which was discussed at great length, is our feeling of the need for one-on-one during the evaluation cycle to make sure that both parties are communicating and have a full understanding of what has been offered by the seller, and that the buyer has fully gotten his requirements across and that there is a true understanding.

That's all the spears that were thrown.

Colonel Campbell

In that discussion, there were some barbs and there were some responses, and we agreed within the Services here, especially on the points of one-on-one and 60/45 days, to take a very long, hard look at this and see if we couldn't respond to that. I, for one, talking outside rules and regulations and everything else, I really endorse one-on-one, the up-front, getting next to the guy, and not having this 600 or 500 questions back and forth. It takes time and money and just adds to the immensity of the documentation we have to maintain on these programs.

What I'd like to do is throw this thing open to your comments, further questions, or anything else. I didn't make one point as we started. We did have a little discussion. Dave Creech, from my contracting group over in NTEC, works through the Navy, made the initial presentation on this to stimulate the discussion which got to these points.

So who is the first to ask a question?

Panel Member

I'd like to say a couple of words regarding waiver. It's interesting that a lot of times with the four-step procurement process, when we get into a program, we have no choice. I think you realize that all the new trainers are going to be funded with RDT&E money for the first article, and consequently we will be forced into the four-step procurement process more and more in the future. Our experience right now is about 300 days for a single four-step procurement at NTEC, and at the same time, our experience level is very low. We've only really fully processed two of them to date and we have in process at this point about three more. It gets important from our standpoint because we're looking at what we're going to be doing in the future and we look at what we've done from 1980 to 1981, regarding the delivery of major training devices and we've seen a tripling of the devices we've delivered from 80 to 81, and from 1981 to 1982, we're tripling that number again. So consequently, the volume of major training devices is starting to go up and at the same time, processing time for four-steps is very lengthy, so there is a definite impact on NTEC in the way we do business. We're trying to work very closely with industry on how to improve this. We recognize that the process is too long. A lot of times the approval cycles that we have to go through are series approval cycles, where we can't take something out of step. It has to be done in series and each time we have to go up the chain of command for the appropriate approvals and then proceed accordingly. So it is a lengthy thing, and what we're going to be looking at is to go through it in detail to see if we can take some of the series steps and put them in parallel and try to shorten some of the times. The quest for 60 days minimum for proposal preparation and 30 to 45 days minimum for cost preparation, I think we're talking in an ideal sense.

Sometimes we get involved in a process whereby we're limited by the kind of money we have and the time we have to work with that money, and consequently, we have to fit the process into the scheme of things regarding the funding. So we're driven by many different things other than just the pure process itself. We will work very closely with industry and try to keep the time-frames down, and I don't know what we're going to do the first time we try to eliminate somebody early. We haven't seen that happen yet.

Question

Will you describe what you mean by the three-step process or modified four-step?

Mr. Turner

I guess the major change would be to break down the communication barrier which four-step sets up. The Air Force is currently in a number of major programs going on a modified three-step and we're allowed to communicate. We still have the written communication, but there is a one-on-one capability that exists to a greater extent than under the four-step. The three-step is like we've always done it, essentially, and four-step sets up the additional rigor pattern that has been thrown in to preclude technical leveling and to effectively set up as the vehicle to eliminate those at the front end before you drag them into phases two and three.

Question

I noted that Bill Turner had made a notation to limit questions to important items only, and if I may, I'd like to extend that, Bill, one step. Having been involved in a few four-step proposal preparation efforts, I note that the technical proposal requirements which pretty well determine your proposal effort and the extent of your proposal, have become such that you almost are forced to respond to every single specification paragraph without any deviation, almost, and it would appear that to extend that, perhaps the technical proposal requirements can take a look at the more important parts of the specification and emphasize those, and perhaps some of the less important parts which are not going to really drive the driver, not be emphasized.

Mr. Turner

That was discussed as a principle, and it was generally agreed throughout the room that that should be an objective, but where you cut that threshold is certainly a subjective kind of thing, because it's important to whoever established the requirement originally, and if he wants something answered, I don't know how you'd say it's not important. I don't know how you'd implement it.

Panel Member

I'm not going to get into trying to give you the strategy for putting together the technical proposals. The technical proposals are of concern to us as well as you. We were concerned from the standpoint that we wondered if industry had the confidence in NTEC being able to competently evaluate the technical proposals as well as competently evaluate the cost proposals. And I think that we got a very strong vote of confidence around the table that industry feels that NTEC is capable of looking at the technical proposals and coming forth with the right kind of evaluations.

Now, whether you have to address each and every specific paragraph in a technical proposal or to what degree you address them is, I think, the corporate strategy, really, how you want to present your case.

Colonel Campbell

The second major point of discussion concerned contractor support services and we had two sides of the story. One that was presented by Gary Morton from NTEC, and one that was presented by Joe Montalbano from AAI. Actually, they kind of coincided on a lot of the points. Bill, would you please report out on that?

Mr. Eager

The term "contractor support services" - I just want to mention one thing. Some of the industry folks that I had spoken to thought they were talking about contractors supporting delivered equipment, and came prepared to talk a little bit about the support equipment and support personnel. But the true definition of this discussion was the utilization of contractor personnel by NTEC and PM TRADE to essentially aid and assist them in doing their chartered jobs. Gary Morton went through many pros and cons relative to this process. Both the Captain and the Colonel spoke about the increased numbers of simulators and training devices and the relative ease in obtaining monies to procure those systems, but the near impossible situation arising in getting personnel in order to contract to develop RFPs, to do the analysis and to do the evaluation. So the Government has been forced, then, to call upon industry, another segment of industry, if you will, to support them in the procurement and evaluation process of simulators and trainers. So this had become an issue that Jo Montalbano spoke very well on relative to the potential injury, if you will, to industry by virtue of this process. So if you can just put yourself in the position of the overworked personnel at NTEC and PM TRADE, and try to visualize how they would handle this problem is what the discussion centered around. The ideas generated by the Government side stipulated that they have personnel ceilings. They are unable to penetrate those ceilings by hiring new people. Although the numbers of simulators have greatly increased, the

personnel have stayed stable. The people onboard were the people that they needed to do the job, and over the years the increase has been tremendous.

The industry concerns - and those from industry I'm sure can picture this - is the fact of how are industry rights at this time going to be preserved. Companies in this particular business now are more and more competitive, and the environment is becoming more competitive. Companies are teaming more. The support services personnel are mobile and they can move between contractors, from software support services contractors, if you will, into competitive situations. So this is a problem as industry sees it.

It's difficult to keep track of the support services personnel and their interlocking relationships with either primes, second tier study houses, even third tier personnel support services houses. So the matrix of the interrelationships could become very complex and this is not understood by either the Government or industry how all these interrelationships occur. That, essentially, was the problem.

The recommendations that were made by the group were that the Government, in establishing and when establishing an RFP, be up front in identifying specifically which contractors or support services contractors would be involved in the procurement process. The contractors at that time can express any heartburn that they may have relative to the selection of that contractor. Or, if it is distasteful, they can choose to avoid that solicitation and to no-bid. The Government, it was expressed quite strongly, that one phase of the process, that is, the evaluation of proposals to select a winner, should be the responsibility of the Government and should not be delegated down to a support services contractor.

Another point that was brought out in the process that support service contractors in assisting in various phases of proposals and evaluations, that the Government should entertain and in some cases, the Government stated that they did provide hardware and software exclusions, and that was an idea that was generally accepted.

Finally, at the end, one idea was expressed by Captain McHugh and that was that in light of the expanded simulator and training devices demands, that it might be helpful if contractors collectively approached Washington or decision-makers and expressed their concern relative to the manning levels that have essentially stayed stable as the industry has grown so quickly.

That is, Colonel, a summary of the events.

<u>Colonel Campbell</u>

And it got so deep at one point that we were talking about a Government entity asking another Government entity or contracting

with them to evaluate a program, that second Government entity getting a subcontractor to help them, and that guy turned out to be a possible third-phase bidder out here on the actual hardware. So that gets to be pretty deep and you have a lot of ramifications, and that's the kind of things that we discussed.

If anyone has any comments or questions out there, we would certainly welcome them now. Gentlemen, it's a way of life that we're going to have to live with. DARCOM has gone from 187,000 folks in 1968-69 down to less than 100,000 civilians today. PM TRADE hasn't gained any spaces in about the last - well, we were told we were going to get eight, but we'll never get those - in the last four years. We're staying steady. But the budget just keeps going up.

Panel Member

Let me just expand in a couple of words in this area. The business is growing. I think the business is growing about the equivalent to the way these seminars are growing. They're getting bigger every year. And obviously, the interest is in simulation and getting the simulators to the Fleet is very real for the users. Recognizing what our situation was with the continued growth in the business and the stability in the manning at NTEC, we had to start developing a strategy to get the job done and starting in POM 83, which was really last year, we put together a strategy to go up through the chain of command to not just ask for people, but to ask for people and money because money tends to be more accessible in today's environment and in the budget process than people. And so consequently, we strategized for the last two years on how to approach the business part of what we do from the standpoint of being able to fund people and also get people. The results in POM 83 were we got zero people but there is a potential of getting a considerable amount of money. Recognizing that we would have to be looking to contracting out certain parts of the business - when we say contracting out, we mean contracting with a product being the result of that contracting out in whatever area we do it within the Training Equipment Center - we felt that we had to start disciplining ourselves internally. So I put together an internal review group that looked at NTEC in fairly good depth to find out just how we were handling our contracting out business internally, and what our results were and what the knowledge level was within the Command. We found out we had some problems. So we disciplined it by identifying throughout the Command what contracting out meant and laying down the rules of engagement for the individuals involved, and putting out with each contract that requires contracting out, a very detailed questionnaire of what you can and can't do, and the questions have to be answered in detail. We've gotten up to just this last month and we're proceeding reasonably well. Well, there's a new SECNAV Instruction that just hit the street, about a month ago, that corrals all the SECNAV Instructions regarding contracting out and puts them in as references to

a single, more stringent Instruction on contracting out. So we're going to have to go back and look at the way we're doing business in that area one more time, and go through another complete internal review of how we're handling our business and make sure we're staying within the law at this point. But I still feel there will be a considerable amount of contracting out in the future years, because we don't seem to be getting people. I don't see the people on the horizon.

Colonel Campbell

The third subject was low-cost simulators and the seeming lack of interest in industry to produce low-cost simulators, effective low-cost simulators. I'll ask Mr. Robert Johnson to report out on that.

Mr. Robert Johnson

I would like to preface the general discussion about low-cost training with the fact that low-cost training on one hand is a new concept, while on the other hand it is not a new concept. Now, what do I mean by that? Back in the initial days of training devices, just by the nature of the military hardware and the nature of the simulators or training devices themselves, it was relatively simple, back in the days of the blue box and so on. And they weren't very expensive. However, with the advent of technology as it sky-rocketed lately, both the military hardware itself and the trainers and the simulators have become more complex. As a result, the natural fall-out of that is, at no surprise to you, the higher cost.

In general at the presentation, the low-cost concept was brought about and it is here to stay. It does have a place in the Fleet. Low-cost trainers are not intended to replace the high fidelity, high-cost trainers which do have their place, especially in the training areas of weapon systems, tactics, etc. Where do the low-cost trainers fit in? Well, one area is to off-load the full scale simulators if they, in fact, are being overloaded and can't meet all the training problems at hand. For example, it's not necessary to teach procedures on a high-cost simulator if you're running a simulator 24 hours a day. A low-cost cockpit procedures trainer, something similar, can teach these procedures in a much more efficient manner and at a lower cost.

The second area for low-cost training devices is to supply them to squadrons and to reserve units that by their nature do not have the money to purchase a high fidelity simulation device. Now, they may not get 100 percent of the training, but they may get 70 to 80 percent of their training, but it's better than zero percent.

In discussing some of the problem areas, some of the items brought out were as follows. The Government often gets their

military characteristics for a trainer before determining what the training needs are. It was decided that a better definition of the task to be trained should be laid out prior to the procurement of the training device. Another point is the contractors themselves often tend to over-respond to user wants and to give them more than they actually need.

Another thing is that it is very difficult to determine what a pound of training is worth. In other words, what is the optimum trade-off between trainer cost and trainer effectiveness. In addition, contractors find low-cost training hard to sell to users. The users themselves would like to have the best possible product. There's no doubt about that. So why should they settle for a low-cost device when they can get a high fidelity device. It's a matter of economics and money.

Into the system itself there is inertia against change and there is a growing demand for more expensive trainers. As I said before, as military hardware and technology becomes more sophisticated, so do the simulators. The result is an increase in the cost of procuring training devices.

The users themselves want the simulators to replicate the latest version of the aircraft and all its capabilities. And also, there are new uses being found for simulators every day. Right now they are being used as tactical research tools. There are other uses, as well.

Another major point brought out is that in the use of simulators there is not enough money being spent in the training of the instructors to use the trainers. The instructors themselves are not taught how to use the trainers. Not enough emphasis is placed on teaching the instructors the full capabilities of the trainer. The personnel turnover and rotation, normal rotation of military personnel, leads to the subsequent instructors not being taught what the initial instructors have been taught.

These are some of the reasons that the trainers are not being used to their fullest capabilities, or if they are used at the onset, they gradually deteriorate into non-use.

Some of the recommendations that were brought out at the meeting: the Government and the contractor should go jointly to the user, the user being the people in the Fleet, to sell the low-cost trainer concept. Only by working together can the contractor and the Government determine what the capabilities of the trainer should be.

The user should be involved in every step of the development from the requirements generation through the fielding of the trainer. In this manner, the user knows exactly what the capabilities and the limitations of the trainer are that he is getting.

The need for low-cost trainers should be identified by front end training task analysis prior to the design of the trainer. And finally, the Government should spend more money to introduce new trainers and to ensure that initial and subsequent instructors are adequately trained.

That was the generally summary of the Executive Session on low-cost trainers.

Colonel Campbell

We had two or three pet peeve points, or things I gathered over the last year as I progressed from an early neophyte to a medium neophyte in the business. Front end analysis and responses to RFPs and specifications, and laying out the training tasks that the industry developer, the contractor, sees as training tasks that this piece of equipment can meet. We talked about this and we talked about it often, and everyone who comes into my office says, "We'd like to respond that way." I guess we're going to have to make it happen. Folks are looking at it more and more and more and I guess in our interchange with you all, we're getting better at this. We don't have the expertise in the schools and the training centers - the consistent time that a guy spends in the training centers to learn the business and then goes away, maybe 18 months or 2 years - to write the kind of early analysis, to write the front end analysis that needs to be done. Nor do we have a good CTEA process to evaluate it. We really don't know how to put it down - to say what that kind of training is worth. So we're trying to grasp that, but again, I plead with you - we need the help of you all to identify to us what you think those tasks should be and how we're going to meet it with this piece of equipment.

Another point is, the Army is now taking the user, wherever we can - if we go to Detroit to brief the PM M-1, the Abrams tank, on the training devices and their schedule for his tank, we take the user, Lt Col Mike Weaver from Fort Knox, with us. We're in this thing together. We took General Bob Sunell up at our last review on the AH-1 and the AH-64. We're trying to get this thing done so that we get a better understanding of what the user wants and we don't have fiascos down the line three years removed from the first guy with stars on that said, "That's exactly what we want today at Fort Whatever," and three years later, his successor says, "I don't want that - take that thing back and forget it." And we're back at square one and we've spent a lot of money and wasted your time. So we're trying to improve the process from our side - I'm just talking Army now, gentlemen, so you all can jump in here anywhere you want to. That's where I am.

Panel Member

Well, the Navy is perfect in every way, just like they are in football, so I have nothing to add.

Colonel Campbell

The last thing we discussed - and this thing went on for more than +hree hours on Sunday afternoon. We had to cut it off and wind c up. I was hoping we'd get a little more interest out there this afternoon.

The last topic was the high cost of software development, support and concurrence of software documentation and development. I want to ask Bob Stephenson from Hughes to report out on that please.

Mr. Stephenson

I have to be careful here. If the report out is longer than the session, I think you'll feel that it's my report, rather than the conference. So I'll keep this short.

This was a very important subject. It was given all the attention that my colleagues and the military had. However, it was at the tail-end, as Don mentioned, and the other discussions were a lot more elaborate and deep than they were here.

It was triggered off by a subject that all of us have been considering, so we asked David Glenn to give us a presentation and in that presentation, he spotlighted and highlighted a lot of problems that all of us are very familiar with in the aspects of software, especially in the more complex simulators. The cost of software and the development of it, the documentation of software, the verification. Just to spotlight some of the problems that he bro"ght out is the fact that most of the delays - in other words, he went back through in history and you take a look at all of the simulators and you say, "What was the salient reason why they were late." Software. That's the current situation as we look back. He pointed out that the situation doesn't seem to be getting any better, spotlighting statistics, which I'm not too anxious to delve into, but one thing that interested and surprised me. The Air Force has over 485 general purpose computers embedded in simulators, but the important thing, it's bought by the SIMSPO, which has only been in existence for about three years. That's a lot of computing power and also the associated software.

The life cycle costs of the software is about 50 percent of the total systems cost, just in the software alone. He pointed out that 30 percent of the development cost of any simulator is in the software. All these are statistics on the situation we have today. I happened to look at some of the data we had and started thinking about this mix - in the old days, hardware was a big expense and software was secondary. Then software became 50/50. But now, hardware is going down, and the hardware is going to become so sophisticated it is going to require much more extensive software development. So the problem that Glenn and the group, my colleagues, were addressing, we think are going to get better.

It was also brought out, how do we tackle the software. One of the problems is that we need better software people. How are we doing with software people. This is an industry statistic, but I have a feeling that it is also reflected in the military. If our customers don't have the smarts, that's as much a problem as if we don't have the smarts. I picked up a trend, because we at Hughes are very interested in this particular trend. About 1980, we're kind of keeping up with the supply. That's the way we look at it. In about two or three years, the divergence between the demand of software and the supply of professional people we can identify just becomes astronomical. In other words, we're not going to get there from here unless we try and do things a little bit differently.

All this discussion centered around what we can do about it. One of the recommendations which I thought was very good and very well thought out was that one of the problems is that they had to get industry's attention, like the 1644, the specifications, the requirements, is that the requirements for documentation should be addressed, they should be standardized and formal. We're spending too much on software that cannot be reused, we're re-inventing the wheel all the time. One approach was to standardize the specification that goes into real details, really a burden on the contractor, and will increase his costs. If it increases his costs, it's going to increase the cost of the simulators. So what we should do is possibly take what some people described as a CS^2 approach. In other words, define for industry in the software development and documentation program, define what the military wants, what they need, and allow the contractor to propose a system of how they are going to do it. Once that system is accepted, then it could be audited and approved just in the manner of a cost reporting system. This would allow the flexibility of the contractor to come up with his optimum system. The important point here is an awful lot of us in the simulator business don't deal with just one customer. In other words, we have requirements coming from all the different customers and if we have to create different systems, then that's going to increase the cost. That was one of the recommendations. This would give us more latitude, the contractor. It would allow the customer to come in and make sure that we have a system, conduct the periodic audits, and certify the contractor's method.

The other recommendation was to standardize software development. Those are a lot of words - and by the way, there were a lot of words said - and I don't really know how we're going to get there, but there should be some attempt.

Don Campbell has volunteered to take a look at this situation and our recommendations, and go to the Joint Logistics Command to develop a joint regulation along these lines to allow the contractor to formalize, provide the documentation and the development programs required to reduce his costs, but at the same time, give him the flexibility to where he can be cost competitive.

Colonel Campbell

Thank you, Bob. That was a suggestion by General Miley, who sat in through the whole session. He asked the question, "Have you thought of the JLC?" I haven't thought of the JLC since I was back at DARCOM a couple of years ago and what they could do for us in that arena. This is an ideal situation if we could get this across the Services. We're going to work on this very diligently and report out to you, as we're going to report out to you on some of the other points.

Panel Member

The comments on software were very interesting and caused me to reflect back to about 1972 or 1973, when the Air Force formed a group to produce what was called then the Master Plan for Simulation, which was to look at the requirements for simulation in the future. At that time it became obvious that the job was extremely large. One part that comes to mind was that in the initial estimates the requirement just from the Strategic Air Command was for $2 billion worth of training equipment, and one thing that came out was the fact the industry would simply be saturated and they wouldn't be able to produce what all of the Services needed. At that time, I made a suggestion that certain things needed to be standardized, that the training device business was a model shop type of an operation where everything was built as an entity itself and there was no commonality; that there should be some room for standardizing software, a documentation, something, and also a way of perhaps getting around MIL-SPECs or a modification of the MIL-SPECs which would result in standardization but at the same time, reduce costs. The answer then was that it can't be done. I thought then that it could be done and I still think it could be done, but the clock is running and we already have an awful lot of products that are being produced and the number that are yet to come are going to be harder to get because money is going to be harder to get.

Just one final comment - I would like to hear some more on that, but the problem of the complexity that was mentioned earlier, the instructor station, the need to train the instructor, the need for continuity, I think is an extremely good point and I think it also points to needs for the future and my feelings in that regard are that we need to look a little bit more toward the use of civilians for doing these non-combat types of jobs. Not only that, but simulator maintenance, also, which is being done to some degree, especially by the Army and I think very successfully. But the instructor himself - I think too long the military has maintained the position that only someone in uniform could teach the skills that have to be taught and I don't believe that really holds up. As we get more and more complex, we're going to find that we're expending more time teaching the instructor to instruct with the machine than we are in teaching the skill that he's going to have to teach with that machine. These things need to be addressed and as I said before, the clock is running.

Panel Member

I'd like to address one point because I'm sure it's a very controversial subject.

I was aware of that study and we've been looking at. One thing I'd like to say, and this is a personal opinion. The time that we started talking about standardizing and making software reusable, in my opinion the technology was not available to do that. I personally feel that we're getting very, very close to that. The modular aspects, the utilization of higher order languages, this sort of thing, is going to allow us to standardize more on the software, make it more usable. The other thing that we think is the key to reusable software or standardized software is in the documentation. I have several competitive colleagues here; for them to give me their software wouldn't do me any good unless I had the documentation and ability to use that software. So, I feel that the technology back in those days when we talked about standardization and everything, in my opinion we're not there. We're talking about developing programs, software, and this sort of thing that is independent of the host computer. You don't have to specify the machine. You just develop the software.

The only other thing I'd add is to address that problem, the complexity of the system. The complexity of the system should be put into making it easier for the instructor to utilize, not more difficult. The complexity of the device should make it more maintainable, more serviceable and I have seen some progress in that area. Not enough, though. In other words, if we're talking about programming a sophisticated system, you should put a lot more time in developing authoring language. It would allow a very uneducated or unsophisticated instructor to utilize that device and that sort of thing. That's an opinion again, but I have seen some of that developed.

Question

A question was asked recently of a number of people in the business about if they knew the capital investment to support software manufacturing in relation to their capital investment to support hardware manufacturing. The issue, I think, that we're facing is one of increased productivity and the use of less skilled labor to do a big job. So we have to look at other alternatives. I would suggest that innovation and invention, creativeness by industry that has embedded in it standardization and other things, rather than over-regulation. But this should be looked at. I think that capital investment issue in terms of the software manufacturing is a key to one of our problems.

Panel Member

I'm sorry - I think I muddled it up. The group here made a very clear recommendation. That is the intention of the recommendation is to not allow a standardized regulation to come in and tell

us how to do it, what to do and everything like that. On the other hand, we know that we're delivering it to a military customer. He's got to be able to use it. He's got to maintain it and support that software so the key to that is documentation. But we didn't want to impose on the contractor, even in the documentation, restrictive requirements that would restrict his innovation. And you mentioned the key word - productivity. As you are probably aware, we have a commitment of a billion dollars to improve productivity. This is not in terms of hardware. We found out that if we continued on our ways in developing software with the machines we're developing, we don't have enough programmers to program them. It would take us another hundred years to write the instructions if we followed it. So we started treating software with innovation, but primarily the productivity of software. Work benches - make it producible. This requires standardized approaches and I know all my colleagues are doing the same thing. But the main thing we want to do is turn out an innovative product, turn out something with a high productivity, but make sure that it's usable to the customer. And that, I think, is tied up with the documentation and that is tied up with our recommendation to make sure that we provide the documentation. So many times good software isn't even usable or supportable on the system it's supplied with because of inadequate documentation.

Panel Member

It's apparently coincidental, but just prior to this session and this discussion by Bob Stephenson, there was a discussion at a Management Session and the subject was Post-Deployment Software Support. The gentleman who gave that talk - and I'm not even going to try to summarize it - made several cogent and important points with regard to post-deployment software support and, of course, had much reference to the process and techniques, etc., etc., during the software development process that naturally affects that. I would suggest that he had very legitimate concerns, but if some of the items which Bob and the other gentleman have suggested are attacked and perhaps partially resolved, it would also have the effect of alleviating the post-deployment software support problem.

Question

Colonel, if I may address really two points; the first one is in the early discussion about support contractors and their roles as viewed by industry and the military, and the characterization of a military hired gun or something of that order, and the relationship of software and software costs. I think most of us are aware that for over 20 years now, the tactical systems have had in place and operating maintenance facilities. This was driven, really, by the necessity for interfacing these systems. These facilities were actually operated by support contractors under military direction and they have been particularly successful. All of the tactical systems of all of the Services and their interoperability, I think, speak to that particular point. Now,

training devices are being driven to a point at which they're going to have to consider interfacing of systems. Even at this particular point, if you talk about the multiple purchases of systems, you have to consider the consistency, the commonality, and the control. But the fundamental point is not standardization, it's configuration control. And this seems to be the main thing that's lacking through the entire thread, whether it's during the development where that responsibility rests with the development contractor, or the post-deployment period when it rests with either a contractor's follow-on with the Government. And this is not secret. It's a very fundamental fact and I think that it can be very readily addressed. It's control of what you have. That, in turn, will force the production efficiency if the development contractor and/or the post-deployment software support activity have control over this system as it evolves. The post-deployment software support activity in the tactical world really is involved in the early phases of the development. They know what system they're going to have to maintain. And as a consequence, you have a much more efficient turnover of that system. Basically, obviously, I am a support contractor and I feel very strongly that there is a clearcut role in the entire scheme of things and I wanted to make that particular point.

Question

One of the things that appears to me in the software area that is sort of like the old axiom in the Army, "Troops do well what the boss checks." Large software programs benefit highly from a process known as independent verification and validation. It is my conjecture that even on some of the smaller programs which are software intensive, the up front money spent on independent V&V might go far towards solving the immediate development software problems and especially in the support of that software once the system is fielded. The threshold levels that have been applied before for V&V have generally been in programs like ballistic missile defense or something of that nature. Those same techniques, even if they were internally applied within a contractor's own organization would, I think, help alleviate some of your software problems.

Colonel Campbell

That's been registered and on more and more of the smaller programs, we're getting at it. It's a point well taken.

Panel Member

I'd like to make a comment regarding the configuration control of software. There's no question about it. In the training device industry world, we tend to deliver the device into the field with its initial baseline software and then as time goes on, we lose control of the software. A lot of times we've just delivered the device and leave it up to the local people to maintain that configuration. That's been something that's evolved over the past but we're trying to change that. We're making some good strides in some areas. The A6 area is, I think, the most remarkable one.

We have at Herndon Field the data base for the A6 program and we have remote terminals that link to both Woodby Island and to Norfolk so that we will capture the A6 trainers and maintain a configuration data base so that in the next several years that we have to look at the aircraft and possibly additional aircraft to be added to this facility, as the aircraft go through the next ten years of what we're seeing as SLEPS and SILOPS and many, many modifications, we're going to have to revisit those data bases many times over. So we see a very definite need to have a facility that maintains a baseline software data base on all the simulators, major simulators going to the Fleet. If we don't do that and we do have to make a major modification to a device and have to go to that device to first discover what the baseline is, it's very expensive to the Government. We prefer to have that knowledge in our hands and depart with that knowledge in trying to make a modification, rather than trying to discover what it is. We've had to discover many times in the past what the data base was before we started into a device modification. We're trying to make changes in that area.

Colonel Campbell

We would welcome, please, your thoughts and comments on how to make the Executive Sessions more meaningful to you, industry as a whole, and to users, the technicians out here within the military establishment. We tried this this year and it worked out super well on Sunday afternoon. I hope it worked fairly well this afternoon and that you got something out of what we threw out. We welcome your comments and I'm sure whoever the guy for next year is would like to hear how we could do it better.

Thank you very much for coming and thanks very much to the panel.

NTEC PANEL DISCUSSION

Mr. Richard Picton

I'm head of the Support Documentation and Training Division here at NTEC, that's Code 42, and my responsibilities include the acquisition and the revision of training material and support documentation that goes with it.

We requested this panel today in order that we might have the opportunity to share with you some of our concerns regarding the support that is provided to our training equipment maintenance crews and to tell you some of our ideas on how we hope we might improve that support.

Basically, what we're talking about is the same thing that General Otis touched on yesterday in his keynote address, and that is we're talking about the maintainers. Whether we talk about the maintainers for the operational equipment or the maintainers of that training equipment that supposedly is going to support the operational equipment, the end result is still the same. If that equipment is not up, we all have a problem. Some of the symptoms that we've seen that cause us concern seem to be an increasing inability of our support crews to maintain the equipment, the fact that we are having more and more requirements for retraining of those support crews, and the fact that we are continually putting more complex equipment out in the field. All of these things are compounded by the training that we are providing costing us more dollars. The end result is that we're still having down trainers. Down trainers do nothing for our image and, quite frankly, they don't do anything for the image of the entire industry. So I think we all have a common problem until we can, in fact, get some training out there that will maintain the equipment.

In looking at the problem, we are convinced to a great extent that we might be part of the problem in that we've been quite restrictive in how we've told you to approach the overall training problem. We haven't allowed, in all cases, for innovative and creative means by which we can provide training. In short, I don't believe that from an educational technology standpoint we have kept pace with what's happening in the hardware and the software. We haven't allowed industry to step forward and take an active partnership in providing creative, innovative training. And this is what we hope to do by these techniques that we want to talk to you about today and have an exchange of ideas.

Basically, in an overview sense, what we're saying is we want to provide to industry a maintenance concept. We want to tell you what the entry behavior is of those students that we're going to put into the training system, the ones who will have to maintain

the equipment. And we're going to tell you, industry, what the terminal behavioral objectives should be in order for them to maintain that equipment. And we would like to have you help us in coming back and telling us just what type of training they should receive in order that we can realize life cycle real-time training.

To help me in this discussion today, I've asked Stu Steen to join us. Stu is head of our Logistics Division, N-43. There's Dick Tobin, who's head of our Training Acquisition Branch, N-421; Ralph Logan, who heads up our Technical Publications Branch, N-423; and Chuck Windsor, one of our Education Specialists, assigned to our Training Acquisition Branch.

Stu is going to speak to you in regard to the ILS Draft Specification, MIL-STD-1643, and how that spec will, in fact, accommodate these best value techniques that we want to explore with you. Both Dick and Ralph will touch with you in an overview sense the training philosophies and the publications philosophies involved in using these techniques, and Chuck is going to try to walk you through, in very much of an overview sense, the procedures as we see them in regard to exercising these techniques.

At the conclusion of those brief presentations, we would welcome your questions and your ideas on how we can make this sort of program work.

Mr. Stuart Steen

My job is to give you a brief overview of how this fits into the total ILS program that we hope to develop in support of training devices that we acquire in the future.

In keeping with Dr. Harvey's comments yesterday, we are trying to develop a performance specification for the ILS program. The need for a comprehensive ILS program has been known for some time and while logistic support analysis program assures us for major equipment developments, we could not, from a cost viewpoint, apply formal LSA to our developments. So we did two things available to us. One, we developed an ILS specification, and two, we tailored LSA to give us the results that we need within the cost constraints that are placed upon us.

MIL-STD-1643, Training Devices, is the result of these two actions. It contains a performance specification in the body, in other words, a basic ILS specification, and it contains three appendices. The first appendix is the ILS plan requirements. Appendix B is the LSA requirements, and Appendix C, the ILS program verification and supportability demonstration requirements.

The acquisition strategy would be as follows. We, the Government, would furnish to you, the offerors, three things; a maintenance concept, an operational concept, and the basic ILS specification. You in turn would take these three documents, do your

analysis, and the results of that analysis would be contained in your proposal which is Volume II of the proposal, the logistics portion of it, and that would contain your ILS concept for this acquisition.

This proposal will be required to be furnished in the ILS Plan format. As a matter of fact, the successful offeror's proposal will become the preliminary ILS Plan.

After contract award, you would be required to continue this analysis. The LSA is tailored in such a way that there are no formal LSAR requirements. However, your analysis is required in such a way that an audit trail is furnished and available to us, the Government, so that we can follow your thoughts from the RFP on through to the final ILS Plan.

At some discrete point after the critical design, or the design freeze point, you would be required to furnish the results of the analysis in a series of logistics summaries or logistics element plans. This would be the maintenance plan, the training plan, the logistics technical pubs plan, support, test equipment plan, etc. Upon approval of these plans by the Government, this would constitute the execution of the various logistics elements.

You, as the contractor, would be required to execute them in accordance with these approved plans.

After the installation and acceptance of the equipment, and soon after the commencement of the interim support period, there will be an ILS Verification Program conducted, at which time the quantitative elements would be accepted. This would be followed by a validation phase, in which the pubs and the training would be validated. And the final acceptance of the total logistics program would be the result of the acceptance or the successful completion of the supportability demonstration.

This is our plan. How the training and publications fit within that plan, specifically, I will turn to Mr. Tobin.

<u>Mr. Richard Tobin</u>

Since I am actually the Head of Training, what I am going to talk about is training.

In the old method, what we did was to send out a schedule, and we sent out 1423's, and we told you exactly what type of program we wanted, whether it be conventional, thoughts, OJT. We also told you exactly what type of courses we wanted, how long the courses would be, types of courses like instructor course, maintenance course, software course. We also told you - and again I'm talking to the contractors - that we wanted certain data, such as lesson guides, student guides, tests, and what have you. From now on, if we use best value the only thing we're going to tell you is what you've already heard a couple of times here,

maintenance concept, the type of troops we're going to train, and maybe some behavioral objectives. Then what you have to do is come back and tell us what kind of training we need. Or you may want to come in and say, instead of using the conventional type of training course, we're going to give you CAI or some other new type of training - something that hasn't been discovered before. But what we're trying to do is to get you to be creative; we want you to come up with good new ideas in training. We want you to introduce new methods.

So, you see, it's quite different. You're going to have to come back and tell us. Our jobs are going to be tougher because we're going to have to evaluate all these proposals. We may have CAI, somebody may come in with a conventional course. So what we'll have to do is evaluate these proposals. It's going to be pretty tough and I expect to put at least two Education Specialists on these proposals when we go to evaluate them.

Next, I'll let you hear from my good friend, Ralph Logan.

Mr. Ralph Logan

This is a bit repetitious. Along the lines of publications, we're taking off the constraints imposed by specifications. We're asking the contractor to come in armed with the knowledge of what the maintenance plan is, to come in with the best way of presenting data. The state-of-the-art is not frozen. We're asking you to come out with your best shot, knowing what you've got in the maintenance plan. As you've heard over and over again, be innovative. Bottom line, we will always have on-line maintenance and the degree of off-line maintenance will be determined within the maintenance plan. So it's essential that up at the front end, the training and publications people get onboard, so the contracting staff can get this information. It's important that training and publications people talk to one another in the beginning so that they are compatible.

That's essentially what we're after here. For years we've been hearing from contractors that the specifications are no good and we ought to do this and we ought to do that. Now we're throwing the ball to the contractors.

I'll turn this over to Chuck Windsor who will give you a more detailed pitch about what this is all about.

Mr. Charles Windsor

Basically, best value is a three-stage process. The three stages that we're talking about are definition, actual program itself, and the evaluation. Now, anytime I mention training, I'm also mentioning pubs, because we are working in an integrated logistics support program as of this date.

During the definitions stage, this is when we define what the device is. We are going to go out to you, Mr. Contractor, and we're going to say, "This is the device, these are the objectives that we want you to meet." This is all we're going to tell you. And we're going to tell you this by the maintenance concept. The maintenance concept should ride everything, and we'll get into that a little more at a later time.

The second thing is the program. The program is where the contractor defines what the training program is going to be. After we accept it, then you're going to implement and carry out that plan.

Thirdly, we're going to evaluate what you do. Did you meet the objectives in your program and your implementation?

So basically, the program as we define, you do the program and we evaluate what you have done. To carry it out a little further, basically, we have two roads we're going to travel, the top one being the contractor role and the bottom one what NTEC's responsibility is.

To kick it off at a timeline, we have the RFP, the Request for Proposal. At this time, we are going to, as I said before, define the device by a Statement of Work. In addition to the Statement of Work, we're going to come out with the TPR, the schedule, and everything else. As Mr. Tobin said, in the schedule we're only going to ask for a maximum of two 1423's, and that will be the instructor handbook, probably, and the training plan. It depends on the type of device we're utilizing.

So we define the device by the Statement of Work. In the Statement of Work, we are going to bring out the maintenance concept. The maintenance concept leads all other elements in the ILS program. If the maintenance concept says organizational level maintenance, then training, provisioning, anything else, has to go by that organizational level maintenance.

In addition to that, we are going to spell out behavioral objectives that we want you to meet. And that's all we're going to tell you. We're not going to go out anymore saying that we want a 14-week maintenance course, 10-week computer peripheral course, a 5-week software course, a 1-week instructor/operator course. This is for you to decide.

Once we go out, you come in with your proposal, a proposal based on our behavioral objectives and the maintenance concept. You are going to come in with a training proposal, pubs proposal, provisioning, based on the maintenance concept. At that time, we are going to evaluate all of the proposals that come in.

The evaluation concept that we have done in the past is going to change. Before, we said we want all of these courses for so many weeks and everything else. We can't do that anymore because

we're not telling you anything. All we're going to do is ask you to develop the best program that you can come up with, meeting the new innovations, coming up with the latest state-of-the-art.

The proposal evaluation - we have no criteria in order to evaluate you so how are we going to do it? We're going to do it on three concepts, the first one being that you have to come in with innovation, with the latest state-of-the-art that is going to meet our behavioral objectives. The second criteria is that you have to come in with a life cycle training plan - how are we going to support that device for the life cycle, which is normally about 15 or 20 years. Documentation-wise, how are we going to help the Navy retain themselves? Thirdly, you have to come in with a verification plan - how is the Navy going to verify that you met the objectives.

All of this has been outlined in detail in the TPR.

After that we award a contract. As you know, when we award a contract, training and pubs does not have a very big decision factor in who gets that contract. What we do, then, is to go out within 60 days after contract award, and come up with an orientation conference. This is where we go out and say, this is your proposal, this is what we see that could improve that proposal. Based on this orientation conference and the proposal that you submitted, we start writing the training plan.

Then we have what we call an implementation conference. This one is held by the contractor. He comes out and he explains the training plan. At this time, we've had the training plan written. based on the orientation conference and the proposal. We accept that training plan at that time. From then on, the training plan runs for the rest of the contract, as far as the training is concerned.

After that is preparation and implementation. In the training plan, we're also going to pick out certain spots where we monitor you with continuous monitoring, making sure that you follow that training plan. The monitoring is going to consist of design review and monitoring the training plan.

After the implementation has taken place, we go through what we call evaluation of the device. This is a new change, too. Evaluation before, if the training was accomplished it was done by means of a test at the end of each training course. That's not longer effective. We have to have what we call a Student Capability Verification Demonstration. All we're saying is that we want you to demonstrate by means of some type of test on the equipment that these students have met the objectives. In addition to that, we are going to have pubs and training documentation verification by means of a verification conference at the end.

I don't know if I left anything out, but I'll leave the floor open to questions.

Mr. Picton

I think I'd like to make one point. As we pushed here and said "new innovations," we're asking you to take a look at that particular training situation and it doesn't necessarily have to be - I don't mean to imply that it has to be new and innovative. Additional classroom type instruction may be the best means of meeting that particular training need. But what we're saying is we want you to look at the best way in training technology to meet that particular situation. We would like to see means of interactive training - perhaps a good exploration of organic training, as far as the equipment is concerned. We do not want to be locked into the three or four conventional ways that we have done in the past. We feel that it is a direct partnership that has to work between us. As I said before, I think we would have to say we have blinders on if we don't see a problem out there, because we do have a problem.

These were some of our ideas on how we might overcome some of those problems and as Chuck said, we'd certainly welcome your comments, questions, ideas.

Question

(The question cannot be understood)

Mr. Tobin

Certainly. The millenium is here, so we're told. The pendulum seems to be swinging the other way where N-6, our contracting people, and our project directors in N-3 are all saying the total project won't fly unless the support elements are satisfied from the concept through. That's what we're hoping for.

Mr. Steen

If I may just add something to that, I don't think that we can ever hope to get to the point where our Volume II, our logistic volume, carries the same weight or more weight than the technical portion of the proposal. But the one thing that we have done is that we have gotten acceptance of the fact that both proposals have to be acceptable. So while we don't carry the same clout as perhaps the technical areas, ours does have to be acceptable before it can be awarded. It's a minor point, but it's a major milestone as far as we're concerned.

Question

(Cannot be understood)

Mr. Steen

What we have incorporated in it is that we have tried to include the concept of LSA. We do not hope to impose the formal

LSA process on training equipment, because we just couldn't afford it, nor do we think that we need it. I think it's a kind of hunting mice with an elephant gun kind of thing. The title of it will be an ILS Specification for Training Devices or Training Equipment.

Question

Will this be a DOD level spec?

Mr. Steen

No, the data people can help me on this. It's designated as a training device specification, and I think it's limited to training devices. It's NTEC at this point.

Mr. Tobin

It may end up like 1379, which you're very familiar with, you started it. But 1379 is our training MIL-STD, and it will probably start out with Navy - well, local NTEC, then Navy, then DOD.

Question

(Cannot be understood)

Mr. Steen

We feel that it will be applicable to any type of maintenance. If the decision is made that you are going to have total contractor maintenance, the specification would still be applicable.

Getting back to the 1388, the LSA Appendix, what we've done is tailored LSA in the three levels. Level 1, which would be the application of full LSA in accordance with MIL-STD-1388; in level 2, we have reduced the LSAR requirements to zero but we do require an audit trail of their analysis. This is what we're requesting. In the past, the only analysis that was done in the development of a training device was done prior to the development of the RFP. There was certain analysis done within NTEC and we came up with requirements - they stated there would be a 14-week maintenance course, there would be a 10-week operator's course, there would be a 6-week computer and peripheral course and so forth. The analysis stopped at that point. The contractors would just echo our requirements back in their proposal: yes, we will give you a 14-week maintenance course, we will give you a 10-week operator's course, and so forth. Then after the contract was awarded, the training would be delivered, the pubs would be delivered with no integration whatsoever, no inter-relation with one to the other. Pubs may be written in relation to one level of maintenance, the supply would be developed in accordance with another, and probably training maybe would reflect one or the other, but probably neither. So what we're trying to do is get a truly integrated program where

the elements will not only be supportive of the others, but there will be an interacting between each.

Question

Is this going to extend your delivery schedule?

Mr. Steen

No, I would envision that the reliability demonstration will still take place just prior to the in-plant acceptance. This is the way that the reliability demonstrations have always been done. The maintainability demonstration, I would envision, would become part of the overall supportability demonstration, which will be conducted towards the end of the interim support period, the year after the device is delivered. And this will constitute the acceptance of the total logistics program.

Question

. . . . . is weighted at 75 percent, no way are we going to give you computer assisted maintenance programs. That would drive the cost way up. There are so many flexible approaches here that unless the contractor really knows what you're looking for in the way of your criterion to evaluate those proposals, it's going to be almost impossible for you to point out that there are oranges and peaches and pears and what have you.

Mr. Windsor

We do intend to be very explicit in that. Let me say that best value is not the lowest cost. We're looking at the life cycle capabilities, the ability to really get out there and have trained crews that can, in fact, meet the training objectives, those terminal behaviors that we will describe. So when we say best value, we're not talking the lowest cost.

Mr. Tobin

We do accept the fact that it's going to require a lot of work in the area of the TPR, the Technical Proposal Requirements, and we accept that.

Question

(Cannot be understood)

Mr. Steen

I didn't mean to infer that we were expecting the preliminary ILS Plan. What I tried to relate to you was that we were going to require that the proposal be in that format. Then that would become the preliminary ILS Plan upon award of the contract and then

you, as the contractor, would build your ILS Plan on that. This would contain the concepts, so to speak. The final ILS Plan is down two years hence. We thought that we were perhaps saving you some money in retaining the successful proposal as the preliminary ILS Plan upon which you could build. You could throw it away if you wanted to. As I say, we're not looking for the substantive ILS Plan; we're looking for the conceptual one.

Question

I'm reading between the lines and the maintenance concept is to some extent, to drive the design approach, so in effect, that maintenance concept will affect, to some extent, hardware selection.

Mr. Steen

Yes, ideally the ILS Program should affect - not drive, but affect - the final equipment design to some extent. But here again, I don't think that we could ever dream that it's going to drive it, but it should influence it.

Question

(Cannot be understood)

Mr. Steen

This is a detail that I don't know whether we'll be able to settle here or not. I would hope that we would allow the contractor to propose the use of DIDs. If he comes in and proposes a training course, I would hope that if he is going to use a DID, that he would propose it in accordance with that DID. If he's not going to use that DID, he would have to come in with either an example or some other way of being able to evaluate the format and the content.

Mr. Windsor

Stu, I'd like to say something. In our RFP that we've got right now, the one that is sort of a draft, we request that the contractor develop the 1423s and send them in to us with the proposal. Let's say that we've got Jack out here and he is going to give me a conventional course, and he decides that he wants to use 1379, which is our training MIL-STD, and he wants to give me lesson guides and student guides and tests. That's all he wants to give me. Then he has got to list on that 1423 either his standards or possibly standards like DIDs that we've got that go along with 1379. If he lists his standards, then he must give me an example or he must give me his standard or his document. If he says he's going to give me lesson plans, he just can't come in and say "the best commercial standards." What he has to do is send me in his standard that he goes by. In your company, if

you've got some kind of standards that you write your lesson plans to, we want to see it. We don't want you to come in and say that you're going to give it to us in the best commercial standards. We don't know what your best commercial standards are. Either that, or you can use our DIDs - when I say ours, I'm talking about the ones associated with 1379. To answer your question, the way we've got it right now, we want the contractors to come in with their proposal with filled-out 1423s. I don't know if all of you know what 1423s are, but that is the sheet that we use to list the data that we actually want.

Panel Member

May I add something to that, too. At the same time that we're talking about new methodology and innovation and you come in with computer aided instruction, we may not need documentation if it's all going to be in that computer or outlined somehow other than what we know right now. In the future, we may come up with something we don't even visualize right now and this is why we set this concept up this way, to try to make it as flexible as possible to get the best innovations and methodology from the contractors.

Question

In that life cycle, are you going to consider the retraining problem so that we're not just looking at the front end and forgetting about the requirements that are bound to come up down the road?

Panel Member

Absolutely. That's number one.

Question

And number two, are you going to be looking at the dynamics of that training as it changes over to life cycle, as far as the ease of updating documentation and materials?

Panel Member

Absolutely. What we had in mind, as this life cycle . . . documentation, not only does it have to have the ability for retraining, but it also has to have the ability for updating some way. Maybe that updating goes between me and you, or maybe it will be contracted, but we've got to come up with some method where you and the Navy are going to be able to retrain for the life cycle. We can no longer afford every three years to buy a training course and this is why we're going out with life cycle training.

Question

On this life cycle policy on training, are you going to give an estimate of how many people you're going to train every two

years or for the next 18 or 20 years. In some places they're rotated every two years and others stay five years. If you're going to train people to maintain stuff, somebody's going to have to give an estimate of how many times you want to do that over that period of years. Will that be part of your RFP? Will you spell that out?

Panel Member

If we come up now with, say, a computer aided instruction, we're not going to have to worry about how many will have to be trained. All we'll have to worry about is is that training material up to date when the Navy - let's say OJT for right now - OJT instructor, Navy personnel, takes that document and starts to retrain that personnel, he has documentation where he can do his own training.

Question

I know that, but here's what I'm getting at. If I propose a CAI system, and the hardware to handle it, it's a lot more expensive for me to print you a bunch of books. If you just use this book every two years, you're not competitive that way. If you're shooting towards some goal, if I'm going to have to update this material every two years . . . . . then I can become competitive. How often are we going to use this free training? You've probably got history that you'd have to base that on, but would that be part of your RFP?

Mr. Tobin

It would be your operational concept.

Question

Would the maintenance plan address part of that also?

Mr. Tobin

Right. Maintenance concepts.

Question

Dick, I would assume that if we deliver to you a training package that is acceptable, in other words, you evaluate it and it meets your criteria, once we deliver that, that's the end of it as far as the contractor is concerned, unless you make an ECP change to the trainer and include the training package in it. There's no way you can hold a contractor responsible for any kind of life cycle training once the thing is delivered. You have to stop somewhere.

Mr. Tobin

What we're talking about is consider the continuing training requirements up front. That's what we're talking about. We're not talking about life cycle training. We're talking about the consideration of the requirements throughout the life cycle of the trainer up front.

Question

Are you going to define, for instance - we may have three trainers under contract: one of them going to the Marine Corps; one going to the West Coast using TDs; another going to the East Coast using civilians. You're going to have a different training student input depending on what the site is. Are you going to be able to spell all this out in your proposal?

Panel Member

This is part of the operational concept, site capabilities and site deficiencies, what is available as far as maintenance capabilities. But it would be spelled out.

Mr. Picton

We will hopefully have a recording of today's exchange of ideas. We also have some graphs and if any of you would like to leave your names, we'll get those graphs out.

The specifications are in the final throes of draft. We hope that it will be distributed to . . . but we wanted to try to explain what some of our background thoughts were to perhaps get you onboard. But we will, I would assume, distribute to NSIA.

Panel Member

One thing that I want to mention to some of the contractors. I don't know whether you know this or not, but we have been ordered to use different money for training. In the old days, we tied the training right on to the project, but from now on, training is paid for out of O&M monies. Of course, that is the money that would buy gasoline for the aircraft, money that would pay the salaries and what have you, and so it's going to be a little tough from now on to get this money. At least I think it is. But anyhow, it will be separate. Now, the training will be in the contract. There's a possibility in some cases that it will be a separate contract, but in most cases it will be in the contract, but we will be using different type money.

Panel Member

One additional point that most contractors may not be aware of is that O&M dollars expire at the end of each fiscal year. Either you spend it or you lose it.

Panel Member

I think another interesting point that you might want to consider, we've all heard about the possible demise of TD. Let me propose to you that if someone were to wave the wand and TDs were gone a month from now, that no longer would we have this great training source in order to maintain training equipment. So I think you might want to consider how you would go about training people as support people, so that if in fact we were totally contractor supported, just where are you going to get these people and how are you going to ensure that they're out there to meet that contract? So again, I don't really feel that everything that you might do in this tough thinking is lost in case we lose the TD.

Question

Have you considered the idea of contracting for this logistic support separately from the device itself? I know that in some ways that could present practical problems wherein the ILS contractor wouldn't have access to data that the trainer/developer would have. But it seems to me that ILS, the concept of developing support documentation, that's sort of a specialty and right now, the way the Center contracts for things, each major simulator company has to have a department that is geared to developing support documentation. If you would initiate a concept where you could contract for this separately, you could, in effect, develop another small industry which would be more geared toward the specialty of ILS support for trainers, and maybe there would be some sort of symbiotic relationship between these ILS contractors and the device contractors. You could let the device contractor concentrate on simulation, algorithms, etc. I just wanted to throw this out to you and ask if you've given this any thought?

Panel Member

I think your concept is very interesting. The reason that we would have difficulty with something like that is the funding. We have to contract for the total system. I think that that would be an interesting alternative. I don't know why some of you major contractors do not subcontract.

Question

I assume that once your contractor is selected, since all of your training data and documentation can't be priced out on the initial contract, that you can revise what his original proposal was to make it meet your needs, whatever they may be, for that particular item.

Mr. Picton

If you go under the concept that your contract is a license to communicate, hopefully the results are acceptable both to

the contractor and the Government. We would hope that there would be a method whereby they would price out these different sub-elements in the proposal. While the logistics program would be a single line item in the contract, we would require that they price out the training program for evaluation purposes.

Question

But you may never buy what is priced out in that proposal once you award the contract.

Mr. Picton

Unless we make the proposal part of the contract.

Question

Do you have a target date for when you anticipate this will be a part of your program?

Mr. Picton

Well, we hope to have this in final draft by the end of the year.

We certainly appreciate your comments and attention, and hopefully we'll be able to work together as a team and solve some of these problems. Thank you.

PANEL DISCUSSION

REALISM: WHO NEEDS IT?

Colonel Arlin Deel, USA

The panel discussion is about realism -- who needs it? We have a particular panel question to address, as indicated on your program. I'd like to make a couple of remarks myself, and then rather than introducing my panel up here, let each one of them introduce themselves and perhaps they'll have a couple of words to say about the particular panel question. That will give you a chance to formulate your own questions. I think that will be a better way of doing it. I've found in these panels in the past that oftentimes there is a discussion between the panel members, and sometimes it doesn't get out into the audience. I think there are a number of people here who would like to ask some questions about the particular panel question.

As far as realism is concerned, I think it's sort of what is the definition of it. We touched on it a little bit this morning, as far as I'm concerned, when the question was asked, why try to do the entire mission of an aircraft in one simulator. To me, that's talking about realism. Why not do some of the training tasks in part-task simulators. There are points that can be made as far as negative training transfer, which is a bad thing, they tell me. There are also some points that can be made about cost. Certainly, it implies here that as you increase realism, you increase the cost. Is it true that as you reduce field of view, you reduce costs? And is it much more expensive to have full color than to have black and white?

You see the makeup of the panel. I have two from industry and two from the Government. I think that seems to be a fair balance. Let's start on the right-hand side over here.

Mr. Gordon Palmer

I'm Gordon Palmer, Engineering Department, Visual Systems, Naval Training Equipment Center.

If we talk about realism, I'm not going to try and cover this whole subject, but I would like to make a point or two, and that is that when we put together a visual system for a particular set of training tasks, we don't necessarily look for realism. What we look for are training cues. And quite often we find ourselves in the situation of giving away some of the realism that a system is capable of in order to provide specific training tasks. In a computer generated visual system, for example, we may well not use a smooth shading capability or a curve surface shading capability in order to provide better visual training cues. So quite often even where a certain level of realism is available to us, we

may not use it because the thing that's most important to us is providing the appropriate training cues to the pilot.

Relative to some low-cost approaches, for training new pilots our Human Factors Department has suggested that maybe there are some unconventional approaches that we might consider. I'll mention it - I won't attempt to discuss it. There's a possibility that you may want to train a pilot by giving him an outside-in view of his aircraft, seen from his position where he's manipulating the controls, but instead of the aircraft he's sitting in responding, an aircraft that he's viewing through the windscreen responds so that he gets a feeling for what the actuation of those controls does to the airplane.

Mr. Roger Taylor

I'm Roger Taylor, Program Director with the Link Division of Singer.

My own response to the panel question - I felt the question was kind of interesting. It has a certain tone, a sort of damning tone to it. Something is being condemned. The question sort of leads you. It's an excess of realism, excess of cost, field of view, and so forth, and implicitly - and I don't think you'll find me too imaginative if I say that what's being condemned here, perhaps, to some degree, are the extreme requirements that we sometimes find in the specifications for full mission simulators.

Full mission simulation implies enormous fields of view, complete wrap-around field of view, extremes of resolution, the ability to maneuver in an unrestrained manner over a very large piece of real-world terrain filled with details of cultural data, terrain features; the ability to approach terrain features and cultural objects very closely and examine them, in a sense; the ability to have many, many active aerial targets, moving ground targets, ground weapons, air weapons, all simultaneously available in the gaming area and in your field of view; the ability to see aerial targets through a very large dynamic range and slant range out to 10 miles or whatever, with sufficient resolution to detect aspect, attitude, direction of maneuver; activation of control surfaces at very large slant ranges, and so forth. I think many of you are familiar with the requirements of the 2360 project, and they maybe epitomize these idealized, full mission simulation capabilities visual requirement. I, for one, support the requirements for full mission simulation and I think it should be pursued and developed. But I think that it should not be at the expense of looking away from and ignoring the potential provided in part-task visual simulation. And I think the question leads us in that direction, also. The natural answer that question is asking for is part-task training.

I think that part-task visual training is capable, in the right circumstances, of supplying an enormous amount of training in a specific task and can be very cost effective. I think there

are a lot of examples you see out here on the exhibition floor, numbers of examples of shoulder-fired weapons that do all kinds of neat things, and I'm sure are extremely effective for that particular training task.

Part-task trainers can be very sophisticated and very expensive and can run that entire gamut. An example of the complex device, of course, might be the simulator for air-to-air combat out at Luke, a machine devoted to the single task of providing training in the air-to-air combat mode. And really, nothing else.

If you think about the technology required to provide the full, completely unrestrained, real-world capability of, say, a 2360, isn't with us yet and is worth developing. We need full mission simulation capability, but on the other hand, part-task trainer should be or could be the vehicle for learning basic tasks - how to do air-to-air combat before you ever get into the full mission simulator. You shouldn't use the full mission simulator for learning the essential skills. It should be devoted to the full mission training function, not to the air-to-air combat training function.

I think that we're often guilty of over-specifying requirements and it causes us, maybe, to lose the ability to use simpler devices for specific training tasks. An example is the requirement often seen for very large, dynamic range capability and slant range, as an example, for an aerial combat situation. The simulator for air-to-air combat has a limited dynamic range and slant range, yet has demonstrated itself to be a very effective training tool in air-to-air combat. Why? Not that perhaps you couldn't do a better job with a greater dynamic range and slant range, but because what's there is adequate. There are sufficient cues to get the job done. There was a very recently completed study by Colonel Jim Robinson and the people from HRL, in which SAC-trained personnel had flown off against other pilots in real airplanes at the instrumented Nellis range, and the people trained in the SAC went through a one-week intensive training program in SAC simulators, came out startlingly well in those things where it really counted, those things that had to do with air-to-air combat - acquiring another target, knowing when you acquired it, releasing a weapon, and hitting the other vehicle. Really dramatic results with a piece of equipment that has a limited dynamic range in slant range. Now, it wasn't that you couldn't use more slant range capability, you probably could. But there were other cues available, when you could no longer discern the aspect angle and attitude of the other vehicle, there were other cues available to tell you which direction it was going. You could see it moving across a real-world ground plane, and from that deduce, in fact, which direction it was pointing.

So limited capabilities with existing technology can provide extremely beneficial training through the whole gamut of training task requirements in all of our vehicle simulation and training areas. Certainly, we need to develop the technology that can

provide a 2360-type machine one day. The full mission simulation capability is required. But I think the Government - and in particular, the using command managers - cannot really afford not to take advantage of part-task training. They shouldn't miss the opportunity to provide a very good proficiency skill at reduced cost through the use of part-task trainers.

Mr. Peter Gengh

My name is Pete Gengh. I'm the manager of System Engineering at Evans and Sutherland. I think I pretty much have to echo Gordon and Roger's comments. On the question of realism, I think Gordon mentioned that we're really looking for cues in the first instance, and I really think for realism secondarily. I know that may be a hard thing for users to buy, but I think we're finding as the whole technology emerges that as we "peel the onion," as we uncover problems and solve them, as we nibble away incrementally, we discover tricks and ways of prompting appropriate reactions in the training environment that in many cases you would not guess could have been achieved that way. For example, we're not using smooth shading on a tree because you lose a cue, even though the edgy tree looks less realistic. If you use an edgy tree, you start getting parallax cues and height cues and a feeling for what's going on, even though it's not as realistic.

I think in a general sense, our experience as a company with the problem over the years has been that it's not likely in one bold stroke that we're going to solve the 2360 aim. We're all peeling onions, we're all solving problems incrementally. We've had our best experiences when the philosophy that's been used is to pick out a few things and do them well, not pick out everything and try to do it all very well with one all-singing, all-dancing machine. That may come someday, and it certainly is a proper motive to pursue the full mission requirement in whatever way you can. If, however, in the spirit of the comments about part-task training, one can take the full-mission spectrum and break it up into pieces and then start thinking about how to do a really good job with those pieces, even if it forces in a simulation context breaking the mission pieces out over different simulators, different phases of use of a given simulator rather than all at once, I would wager that the end user's experience in becoming adapted to the technology and still deriving effective transfer training is going to be much better than if we all shoot for the sky in one bold stroke.

These issues, I guess - you start thinking about lower cost and how can you get away with less realism - those issues split down into issues related to display formats and display qualities into scene content issues and subordinately into modeling issues. I think where scene content issues are concerned, we ought to be thinking, if you're looking to reduce costs, about focusing on task items or areas by focusing modeling technique on specific regions or particular areas. People are thinking

in full mission context about having thousands of square miles to meander over at random. You really can derive a very positive training experience by modeling certain quarters in high detail, modeling bombing and ordnance delivery areas in great detail, but doing that just where you need it, rather than opening the thing up to a shotgun blast. I think somewhere in the future, the use of generic patterns and textures is bound to play a much more positive role in achieving cost-effective simulation, quite possibly without realism, again, because the patterns, because the three-dimensional textural cues, however implemented, give you closure rate cues and height cues and textural suggestion about a perspective emergency that allows you to do the task, even though you cannot see all the fine grid and detail that you might expect in a real-world picture.

This also implies that in the design of models, it really makes a lot of sense in specifying models and thinking about how to decompose the full mission objective, to think about how to build models in highly concentrated ways that are oriented toward the particular portion of the mission that is required at each stage, rather than trying to make one model that perhaps serves all purposes and does all things in a contiguous sense.

In the display area, I guess it's obvious to everyone that anything that can be done in designing a simulation concept that allows you to work with restricted IFFV's, which allows you to do IFFV switching, even if it's instructor commanded, throwing display emphasis to this part of the field at one moment and over here at some other point. If you can take advantage of narrow fields of view in sensors and periscopes to optimize the way in which the image generator focuses imagery within such narrow fields, all of that will tend to drive costs down.

This ALI thing I find very intriguing and have for years - everyone struggling with how to paint pictures around domes - I think the work that's going into ALI pursuit right now is really good. It's not clear that this specific implementation is the one that's going to survive, but the general notion of being able to focus image generator capacity where the demand is is very compelling and if the human factors issues related to how you put ALI in IFFV patches together, how you steer them, how you solve light compensation issues can be resolved, I think it will have a fairly direct effect on image generator size.

I think in summary, the thing that we would desire most to do is to encourage end users and buying activities to find ways to get in touch with the technology and to let us get in your seat some, very early in the procurement process, perhaps before the procurement processes become formal. Anything that can be done to drag the vendors into the operational space, to get them to try things out, to see things, to cut through the issues, whether you need realism or whether you can deal with symbolic or generic cues, would be really helpful to all the parties involved. I've sensed over the last 10 years or so that there have been many

programs where the end user had very grand aims. The buying agency made some attempts to distill that down into something that was thought to be manageable, and the implementor, from his vantage point, took a whack at the whole thing and there was, in many cases, in the end result some disparity between the end user's original expectations and what fell out the end of that pipeline. There's got to be some way to cut through that situation and the best way I can think of to do that is to induce us vendors, whether it's in demos during procurement or in front end work at our own risk well before procurement, to get us to try things out and see things and evaluate in human factors issues and drag users in and let them play with lollipop trees if that's all the technology will provide at that stage, so that they have a much more realistic feel for what they're going to be able to work with and what is effective when they finally buy that.

Mr. Richard Heintzman

I'm Dick Heintzman. I'm the Chief of the Simulator Engineering Division, Aeronautical Systems Division at Wright-Patterson.

I find myself in position number four - I think Colonel Deel threw me a curve. I sat at this end hoping he'd start at this end rather than the other. It's hard to be number four and figure out what you're going to say. We had a discussion this morning and covered a lot of this material. But I'll make an attempt at it.

Going back, looking back in visual simulation, I think we find that we've been building systems - Air Force and Navy both - for probably 15 or 20 years now and if we look at the number of hours of training on these devices against the amount of money that's been spent, I think it's pretty obvious that what we've done so far hasn't been cost effective. Unfortunately, I think there are several problems related to this. The technology has changed. We started off and built such things as camera models, flying spot scanners, film systems. New things come along and it seems as though we're always chasing our tail in this world. We can't get a prototype system out in the field, get some operational experience on it before there's something new and glorious that comes along and now we've changed our focus - we're not worried about that, we're worried about the new thing. I think one of the biggest problems that has faced us and that faces us today is very, very limited lack of experience. We really don't know how much fidelity it takes to do the training. We don't know how much detail it takes, how much resolution. Roger mentioned the aircraft resolution with SAC simulator being low, but they still find they can do a lot of training. These bits of information can only be found out through experience. One thing that we in the acquisition community are being faced with is a user who hasn't got the experience and of course, he's looking to duplicate what he sees in the real world. I think coupled with this, we've got another problem of the engineer's driving requirements, both

the acquisition engineering within the Government and the contractor engineering, too, who find this new exotic technology could be a real challenge, and tended many times to go along with the using command who is looking for something that is highly realistic. These factors together, we seem invariably when a new requirement comes out, to want to specify to something just a little bit better than the last time and that "just a little bit better" can make the whole thing fall flat.

As far as what affects realism, I think there are several things that affect the image quality - and image quality is such things, not just resolution - you have to worry about resolution, you have to worry about brightness, you have to worry about contrast, detail enrichment. There again, I think what Peter alluded to about this thing of generic information, detail can be important in such things as low level navigation, if you're too simplistic it makes the problem far too easy. There may not be much training value. On the other hand, for landing and take-off, a small amount of detail may be very satisfactory because you don't have the problem of trying to determine, for instance, where target areas are or ground checkpoints.

Another thing I think that we must worry about as far as realism goes is what I call disturbances. I think this is something that is rather hard to live with. It affects the training from both the standpoint of throwing up a barrier to the training and to the pilot acceptance. Pilot acceptance, I think, is an important factor. If you can readily provide color without a greal deal of cost, it may be worthwhile just from the standpoint of pilot acceptance. But disturbance is such things as in CIG system where you have problems as . . . drop-out, simulation effects, streaking and these sort of things, I think are very disturbing and we're better off, maybe, living with lower level information systems that don't have these types of effects.

In conclusion, we can't duplicate the real world in the visual area. We must define those cues that are most important. One problem that I feel we have had is that we find ourselves in the position of negotiating with the user where - I think we have a common goal and that is to provide a piece of equipment that is going to get the training done. But sometimes I feel that we argue over such things as resolution, the area of the data base, the size of the field of view. The user wants 180, we say we're going to give him 60, and we negotiate to 120. This is ridiculous. I don't think we should find ourselves in that kind of position, but it very often happens. On the other hand, we cannot ignore the problem of pilot acceptance. That's very important. The question of part-task trainers, I think we have to learn to crawl before we walk, and if part-task trainers is the way to do it, why - here we have been in the tactical simulation area, we've had systems under contract off and on for 20 years. The only thing in the Air Force operational at this point with an operating command is the simulator for air-to-air combat. In the air-to-ground regime, the human resources lab simulator is being used for

some training. But it's a sorry state of affairs when you look back at the amount of effort that's gone into the tactical simulation problem and the few results we have for it. A lot of it is a matter of keeping to some reasonable requirements to provide something that is reliable and maybe doesn't get 100 percent of the job done, but maybe gets 60 or 70 percent of the job done.

Colonel Deel

Why don't we open up the discussion now. If you have something to say out there, please don't hesitate to hold up your hand. You've heard some comments from my four panelists. Some of you may have some equally enlightening comments to make and you don't have to necessarily end with a question. If you have a question, my panel will try to field it for you, but if they can't, perhaps there's someone else in the room who can answer the question just as well.

Question

A comment and a question. The remark was made that you need visual cues, not fidelity or . . . parameters. In the last 20 years, has any analysis been made on the visual cues beneath any specific task? I've been looking at them for the last 20 years, In the take-off and landing tasks - has anybody ever really enumerated what the pilot sees when he uses those cues, or in the air-to-air tasks? I haven't found anything. Can anybody answer that in the positive?

Mr. Heintzman

I think there are bits and pieces of such information. For instance, we try to get the user to describe - don't tell us how much resolution you need. . . . . . and from that we try to establish what resolution it requires to be able to perceive that. In the refueling task, there are certain cues that we'd be able to extract from the user. If you look at the landing and take-off we may know less about that one than we know about something like the refueling task. But there has been an attempt, but the information has been very slow coming, and I think one of the problems is that we could have used more Human Factors support in this area. If you ask some of the Human Factors people, they'd say that that data is out there, but it doesn't seem to be out there in a way that the engineers can relate to it if it is.

Question

This comment about finding things the hard way, by bits and pieces - I think there is a great truth in this and I think there is also great truth in getting pilot acceptance. A good example of how engineers can look for the wrong thing, back in late 1973, we were looking at a . . . 2 simulator, which was over at San Francisco, with a commercial airline. We had an engineering test pilot with us, a very proficient pilot, and we had the Human

Factors with us. We all crowded into the cockpit. We were looking out the window at a scene of Chicago Ohare and the test pilot wanted to get the maximum offset, both laterally and vertically, to see if he could hit himself on the flight slope and make a landing. We were looking at the horizon off to the right. It looked like we . . . . on Lake Michigan. The pilot scratched his head and said he couldn't remember those being there, but he brought that airplane in, got it on the flight slope, and lo and behold, those . . . sprang upright and became . . . When we asked the pilot if he had seen that, he said no, because he was so engrossed in looking at the point of landing that he wasn't paying any attention whatsoever to what was happening off to the side on the periphery. It may have been important from a peripheral point of view, but as far as the dynamic scene, it didn't bother him too much out there. Then we found out another thing the hard way on scene texture. We had a black and white model board which the pilot complained about hitting the runway too hard. We finally ended up putting in more and more detail. Finally ended up on a scale of 1/160th with a garnette sandpaper runway, which gave him the motion cues that apparently are used to judge not only speed but height, because the closer you are, the faster these particles move. We discovered one of these things about this time last winter when we were doing some experiments on getting more scene fidelity. Our pilots were complaining about a homogeneous black and white scene that we have on a scale of 1/1000, so we put a little more detail in, then someone suggested that we just put globs of information, 50x50 foot areas out here in the touch-down zone and in the approaches. We didn't care what was out there beyond that. Surprisingly, we were able to get to the point where an experienced pilot could judge his sink rate down to 2 feet per second, which had been an impossibility. We're going to transfer that information out to our new CDI system, and in fact, we have already put some of that detail into it for that particular type of a cue.

Question

I'm from Bell Aerospace and I'll put myself in the category of a user in this case. I'll make a comment and then I'll ask a question and/or make a recommendation.

I think what we ought to be looking at, instead of using the term realism, is training effectiveness. That's what I, as training manager, am interested in. What is the training effectiveness of the various things that the simulator contractors can give us. For instance, there's a flight simulator for making the approach to Hong Kong Airport, and it's exciting. But should that be an expensive or cheap mount as far as the CDI? The same thing with other types of trainer simulators. I dare say, those who have been in actual combat haven't worried much about the shadows but if you see the enemy and you have to shoot, you don't worry about any five o'clock shadow. I really would ask a question and then make the recommendation, can the Services undertake a study and tell us users, contractors, what are the things that are training . . . and those are the things that we ought to

stress when we procure a simulator. I think that's the kind of things I'm looking at as a training manager. Is it cost effective? Is it training effective to have a mountain with all the gullies and rocks on it, or can we have a cheap mountain course? That's my question. If the answer is yes, we have a study, I'd like to see it when we break up.

Mr. Gengh

It's very difficult for people to specify in advance what's going to be training effective. They really have very little knowledge about it. In fact, it's only recently that they've had equipment, training equipment of any kind, that they could have used as a basis for making the study. And that's all sort of after the fact, isn't it? You have the equipment first and then you say, "now let's find out if it's training effective or not."

Question

A couple of months ago, for instance, a Colonel out at Nellis whose name escapes me right now, told me about the . . . study was determined not to be training effective. He didn't specify is this sitting in the back end running a weapons system training, or was it a pilot flying a simulator. These sort of things I think we'd all like to see.

Mr. Taylor

The more ambitious you are in the training tasks that you're going to accomplish, the more difficult it is to say something about training effectiveness, I think. You can zero in on a specific training task or two without getting too greedy, then maybe you have a chance for specifying what the requirements are to train for that particular task, but when it starts to become very all-encompassing in terms of what you're going to train in that particular device, it becomes more and more difficult, I believe, to say what's going to be effective. Again, that's sort of saying, maybe if we started thinking a little bit more in terms of zeroing in on part-task training devices, there's a chance, by specifying singling out a particular task or maybe two tasks that you're going to try to accomplish with the device - the greedier you get, the tougher it gets; the more demands you place on technology to supply whatever it is you finally determine you need, the more difficult it is to say what's going to be effective from a training standpoint. If you narrow the scope of it down and don't get greedy, then maybe you've got a chance. Maybe your training psychologists have a chance of answering your kind of question.

Mr. Palmer

I really don't think we have any good answers on training effectiveness. As Roger says, there are means of finding out in isolated instances what's going to be training effective. There are means of determining what you probably need in a specific

circumstance - the mountain going into the Hong Kong Airport, assuming you're coming in in a commercial airliner, fixed wing, no, I don't think you need much information on that mountain. If you're going to try to fly up close to that mountain in a helicopter and land on it, then I think the amount of detail that you need to get the job done is considerably different. So training effectiveness can only be addressed in terms of specific training tasks that you're trying to address on a one-to-one basis. And perhaps must only be addressed in the context of what that trainer is designed to do overall. But some kind of overall training effectiveness statement as to what it takes to make an effective trainer to do a broad range of things in an unspecified trainer, I don't think we have any answers to that. I'd be happy to hear from some of the Human Factors people in the audience that might like to respond to it.

Colonel Deel

Before we hear from some of those guys, though, and believe me, I've talked to quite a few of them and you can get quite a few different answers to that question.

One of the things that impressed me, though, about the statement that we were just talking about is the need for a total training effectiveness. That is what we're talking about. But some other comments that we heard earlier in the discussion, also, I think, are very pertinent. And that is sometimes we don't know exactly what it is we need, so we tend to ask for everything with the assumption that we will recognize what we want when we see it. The Government has been accused of doing that - especially people who write requirements. And I've been in that situation, too, where I've questioned requirements. But I have not been able to say with any certainty, and I think it is the lack of study, perhaps, of documentation of some of the questions you were talking about. For instance, motion. You mentioned that the gentleman up at Nellis said you don't really need motion for a training simulator. Well, let him come out - and I invite him to come out and I'll put him in a really large motion generator, something that can go 100 feet laterally or 60 feet vertically with 20 foot lateral capability and just two of the degrees of freedom. And I will guarantee you that I can devise a test that will make him think he needs motion. You can also devise a test that will prove absolutely that he doesn't need motion, and I believe that, too. So I really don't think that we can solve anything with talking about the need for motion.

Earlier, though, the question about have there been any studies about what you do look at, as far as doing different types of maneuvers, and what is needed, I know that the Army has done some work down at the Army Aeromedical Lab at Fort Rucker about the cues that are needed to do certain types of flying tasks and those sort of reports are available to you.

Mr. Heintzman

I thoroughly agree with you on that. You have to look at the task, as far as, say, the motion issue, and most certainly I think there are tasks where motion is very important - such things as on an A-10 if you have manual reversion or I think avoiding departure at high angle of attack in aero combat could even be important. The trouble is, we don't do a very good job of simulating it. Roger was talking earlier about the simulator for air-to-air combat, we did extensive studies on that initially, looking at motion, but we looked at canned maneuvers. We did not look at what really happens in aero combat, when you get into a real hassle and the bandwidth requirements go up on your motion system and the bandwidth was such that the system essentially fell apart and didn't do the job. Under those conditions, it most certainly was better to shut the thing off. Again, the issue of field of view - relaying visual to motion - if it's a wide field of view visual system, those cues tend to be very overpowering. All these cues tend to reinforce themselves. If you look at motion, a G suit, you take all these up together and they all will reinforce each other, but you can take some of these cues out and it doesn't seem to matter that much.

Mr. Palmer

I think the situation that Dick was alluding to is a case where the motion cues were actually lagging the visual cues and in a wide angle visual system, if you get that situation where the visual cues are, in fact, leading the motion, I think you just tend to ignore the motion cues. If you've got that situation and you make a decision on that that you don't need motion, then you really don't have the proper situation to make the decision from. I believe there is an Air Force study that indicates that motion cues that are motions in response to pilot control actions, that are the normal responses that you would expect - you pull back on the stick and the aircraft pitches up - you probably don't need those motion cues. But if you've got a situation where the aircraft is basically unstable, in the case of a helicopter for example, where the pilot must respond to disturbance inputs, then I think the motion system can be very, very valuable. And I think motion cues, particularly in the helicopter application, have a very large bearing on pilot acceptance. To fly around in a helicopter simulator without motion on is not very impressive, but if you put the motion on, the sense of realism goes up tremendously. I know we're talking about realism, but as far as pilot acceptance is concerned, I think it has a significant bearing on it - and in the helicopter case in particular, it has a bearing on being able to respond to motion cues that are disturbance inputs. And if the motion system has adequate frequency response to lead the visual, as its acceleration inputs properly should, then those motion cues are valuable because they precede the visual cues.

Question

(Question cannot be understood)

Mr. Taylor

There's no one answer to that, is there? It's a function of what you're doing. If it's a helicopter that's approaching terrain and trees very, very closely, that's one requirement and if it's air-to-air combat, that's something else altogether. Again referring back to the simulator for air-to-air combat, that's flying over terrain that consists of a grid of half-mile squares. Perfectly adequate for providing the height above terrain and the velocity cues required in that training situation, but it would be hopelessly inadequate for the helicopter thing. I certainly don't know of any studies that could tie it down and the answer is just such a broad spectrum.

Mr. Heintzman

I think, too, it relates more maybe to specific cues than density. If you look at formation or refueling, specific details could be a cue. If you're in very close, of course, the perspective, the geometry is a very, very strong cue.

Mr. Palmer

I think the majority of the work that's been done in this area has been done out at Williams on the ASPT, where they've looked at these tetrahedrons that they put up today, and the various heights, various spacing. They have worked with that quite a bit but I don't think it's to the level of detail that you're asking for, and again, it's for specific fixed-wing applications, and specific velocities and altitudes, but that is our major source of information at the present time as to what's needed by way of 3-D cues for flying close to the ground and getting adequate 3-D cues.

Question

(Cannot be understood)

Panel Member

I can't really answer the question unless I have a good definition and the definition of realism must be in terms of things I can get at, or at least to the maximum extent. If I just have a whole list of items - if I take resolution as one of these items, whether there are two items, ten items, or fifty items - there should be ways to vary this one parameter systematically using a research simulator. In fact, this should have been done years ago. And give me an idea of what I need in terms of ranges of good and bad, I could define enough of these parameters over ranges systematically. Until I get some studies like this, I'll just be guessing and picking the best model I can actually get my hands on, like buying a color TV.

Colonel Deel

That seems to be a pretty good point to stop at, particularly since Dean is a member of the Army Aeromechanics Laboratory, he has access to engineering simulators. I see no reason why we shouldn't charge him with conducting such a study and then reporting back to us next year at the next Conference.

I certainly want to thank the panel. I think they did a good job - Mr. Gordon Palmer from NTEC, Mr. Roger Taylor from Link, Pete Gengh from E & S, and Dick Heintzman from the Air Force Aero Systems Division. I also want to thank all of you who participated. I think we got something out of it - I certainly did. We talked about the need for training cues, talked about affordability. As a matter of fact, General Starry talked about that yesterday and that, I think, also relates to our earlier discussion about trying to get a full mission simulator when perhaps - perhaps - a part-time simulator can do the job just as well. It all, I think, relates to training effectiveness. I think that if you want to talk about realism, and do we need it, I think certainly that you need as much as you can possibly get to train as effectively as you can. A lot of things come into play there and certainly cost is one of them, as General Starry did point out yesterday. And I think it's a shame that that one incident that he talked about, where the cost of a particular simulator was escalating so much that it was just cancelled due to the cost. I think that something should have been saved out of that particular project.

Again, I want to thank you very much. I'll see you at the banquet tonight.

DECEMBER 1, 1981

CONFERENCE BANQUET

Mr. Merl

Before we get to our featured speaker this evening, I thought I'd like to introduce a few of our guests.

First of all, since the American Defense Preparedness Association is hosting this particular conference, I'd like to introduce the President of the American Defense Preparedness Association, General Miley, who is here with us tonight.

We also have with us tonight Congressman Newt Gingrich, who is to be our speaker at the luncheon tomorrow.

And then I'd like to introduce four gentlemen without whose support, whose efforts, personally on their own parts, the people who have provided the resources over and over again to make this conference a success in the previous years and I expect will do so again in the future. Those are the people directly on the firing line for procuring the simulation devices. This year, of course, the Army is the host Service. Colonel Don Campbell, Program Manager for Training Devices; Captain Jack McHugh, Commanding Officer of the Naval Training Equipment Center; Colonel Al Castellana, the Marine Corps Liaison Officer at the Naval Training Equipment Center; and our newest addition, Colonel Redenbacher, the Deputy for Simulators from the Air Force Aeronautical Systems Division.

Our speaker this evening is a gentleman who has had a truly distinguished career, both in public service and in industry. In 1973, he was appointed by the President and confirmed by the Senate as Assistant Secretary of the Army for Research and Development. In 1975, he became Under Secretary of the Army. He was awarded the Department of the Army decoration for Distinguished Civilian Service and was twice awarded the Department of Defense medal for Distinguished Public Service. He is President of the Association of the United States Army and Chairman of the Defense Science Board. He is very well known throughout the industry. He has published many books, articles, has lectured. He is currently associated with the Martin-Marietta Corporation, is Vice President for Operations. Ladies and gentlemen, I'd like to introduce to you the Honorable Norman R. Augustine.

Honorable Norman R. Augustine

Good evening, ladies and gentlemen. I appreciate that kind introduction. I liked it a lot better than the one they sent me in the advertising brochure that said I would be here to simulate a speaker.

Actually, I should say at the outset that I am a strong believer in training. I'm a believer that training is probably one, if not the most highly leveraged factors in building a more effective military capability. It may also be a mother lode for business in the coming years. I'd like to add a few cautions to that this evening. One of the cautions could perhaps be best illustrated by a story that allegedly took place quite near to Orlando. It seemed that there was a circus here. They had a trained bear. The bear had been trained to drink beer as part of it's act. This particular bear had gotten away from the circus during its winter stay here and as it walked down the street, it came by a bar. The bear walked into the bar and as luck would have it, it was the first day on duty for the bartender in that bar. This giant bear went up and put his foot on the rail and put down a $5 bill and said he would like to have a beer. The bartender was a little taken aback and went back into the back room to see the owner. He said, "There's a bear out there and he wants a beer." The owner said, "Does he have any money?" The bartender said he had put a $5 bill on the counter. The owner said, "Well, go ahead and give him the beer, but that bear probably isn't very smart so you just put a quarter down in change." The bartender went back out and gave the bear the beer and put down a quarter and stood back to watch. The bear stood there sipping the beer and finally the bartender couldn't stand it anymore and he said, "You know, we don't get a lot of bears in this bar." And the bear looked at him and said, "Well, at $4.75 a beer, it's no wonder." I hate to tell you this, but I think I've seen more training equipment in that room over there tonight than I've seen in traveling all around the world in our armed forces. And there might be some connection with that story about the bear.

I suppose one might legitimately ask if training equipment is as good as many of us believe, why is it so hard to find, why is it so often neglected? I suspect one reason is that I think there's no other commodity in the military that's more perishable than training. We're all familiar with the learning curve in production. Well, there's apparently a forgetting curve in training. One finds that that is exacerbated by the turnover in people that we get by our practice of rotating the military forces all the time. One is hard-pressed to find a crew in an aircraft or tank that's been together as a team for more than six months.

The question of how much one should spend on training equipment, I think, hinges on one very simple question that I would have to ask you. That is, when do you want to go to war? If you're going to go to war three months from now, you should spend all your money on training. If you're going four years from now, you should spend none of your money now on training. You should spend it all on procurement. If you're going ten years from now, you should spend it all on R&D. So the matter of balancing the expenditures between training, procurement, and R&D

and O&M is a very complex issue, obviously. Training is a tricky business in terms of including it in the budget. The pay-off from it is often much less readily measured than, say, the pay-off from buying an additional aircraft carrier or buying an aircraft that flies an additional hundred miles. There's a tale from another circus nearby where a fellow had trained a flea to jump over a pencil on command. There were some systems analysts that were here for a training conference, so they went over to see this trained flea. Actually, these were cost analysts from the Pentagon. (How would you like to have a job that when someone mentions it, everyone laughs?) These cost analysts went to see this trained flea and the owner told the flea to jump and sure enough, it jumped right over the pencil. As cost analysts are want to do, they said, "The flea is over-designed. It has six legs and all he needs are two to do that." The owner said okay, and tied two of the legs together and said "jump" and the flea made it over again. The cost analysts said he still had too many, so the owner tied four of the legs so they couldn't move, and said "jump." The flea still struggled over that pencil. The analysts said that the ultimate proof was to tie all the legs up, so the owner tied all six legs up and he told the flea to jump. The flea just laid there, and so the cost analysts went back to Washington to give their report and said that when a flea has all six legs immobilized, it becomes hard of hearing and belligerant.

It turns out that it is, indeed, difficult to measure the pay-off of training and to properly interpret data where one is trying to show what the benefit might be from increased expenditures on training. My first first-hand brush with training and pay-offs from it goes back some years ago when I was working in the Office of the Secretary of Defense. At that time, there was an air defense system - the old Hawk - that was deployed in the field and the intent was to improve it. I was asked what would be the thing that we, as engineers, might do that would be the most significant in improving the capability of Hawk. What happened at that time, the Marines had some Hawks out at 29 Palms and they were conducting a series of experiments where the Air Force was flying simulated raids against these Hawk batteries and I tried to correlate the parameters of those raids with the performance of the Hawk to see what was important. I found very little correlation with things like electronic countermeasures level, with things like altitude, speed, Gs, and to my amazement, the strongest correlation I found was with day of the week. I went back and started looking into that - and it's not what you think. What it was was that the Marines were rotating in new personnel to man the Hawk units over the weekends and these were well-trained people. By the experience they were getting from operating in this very realistic environment against a lot of aircraft attacking, they improved so much during the week from that training that my conclusion was that that experience was far out-weighing anything that we as engineers could possibly do to improve the capability of the Hawk.

I thought that was an impressive lesson, at least to me, of the benefits that one can get. The other pay-offs of training and simulators in support of training are also well known. Savings in fuel has become more important. Safety, particularly in simulating aircraft malfunctions.

There's also an important side benefit that we sometimes overlook in training, and that is the motivational affect that good training aids can have. From simple things - I remember seeing an Army unit in Hawaii. They were assaulting a position as part of a training exercise and they were video taping this so they had instant replay. Those were one bunch of turned on troops, getting to watch themselves after the fact to see what they had done and what they had done, perhaps, wrong.

Today, we have kids in this country that, whereas in World War II the kids were experts in taking automobiles apart and putting them back together, today the kids are great with computers and computer games. As we saw out here, I think we've got the makings of a marvelous opportunity to train the people in our armed forces using that interest they have. I think if we put a computer game in every barracks, though, they'll ignore it because they'll think that we're trying to teach them something. I think what you have to do is charge a nickel for an hour or something and they'll think it's really a great deal. And then what you do is everytime you get a passing score you win three hours of free games or something.

One of the dangers, of course, with simulators, particularly those that simulate a task of human dexterity or judgment task, is that the simulation has to be awfully good because just as you can teach people to do things correctly, it's awfully easy to inadvertently teach them to do things incorrectly or to try to beat the simulation rather than to try to win the war or the battle. You have to have a smart teacher. General Abrams, when he was Chief of Staff of the Army, had a story that I think was one of his favorites. He told about two football teams that were in a game. One was an enormous underdog. Through some miracle the score was tied with two minutes left in the game. The team that was the big underdog had the ball, first down on their own 5- yard line and the coach called time out and got the quarterback and said, "Say, now let's don't blow the chance for a tie here. You run the ball quarterback sneak in the middle of the line three times and then drop back and punt the ball as far as you can if the gun hasn't gone off." Well, the quarterback took the ball on first down, ran into the line and by some quirk, the linebacker and the tackle accidentally tripped each other and he ran about 40 yards before they brought him down. The second play, he ran into the line again, gained about 10 yards. Third play as he was running into the line, the ball popped out of his hand and the tight end caught it and ran all the way down to the 1-yard line before the safety man tackled him. By now the crowd is going crazy. They line up on the 1-yard line, the coach's heart is in his hand, and all of a sudden the team

shifts into punt formation, the quarterback drops back and kicks the ball out of the end of the stadium. As they're leaving the field, the coach put his arm around the quarterback and said, "Son, what were you thinking out there when you did that?" And the boy said, "I was thinking what a dumb coach we had." Maybe if General Abrams were able to be here, he might point out that in our simulations, we can do a lot of harm as well as good if we don't have fidelity in the kind of coaching we give.

One of the areas I would commend to you for particular attention in the use of simulators and training concerns combat in electronic warfare environment. Very often, when I've had the occasion to ask people why they're not simulating EW in an exercise, the answer will be, "because if we do, the whole exercise comes apart." That's a bit disconcerting. True, it doesn't make much sense to be planning a big training exercise on the defense of a carrier battle group and then not have the red assault show up because their communications links were jammed. On the other hand, in a command exercise, I think there is a great deal that can be done with simulation to help people make decisions in the real world environment of electronic countermeasures where you're dealing with uncertainty, you're dealing with incomplete information, you're dealing with partially incorrect information, you're dealing with a great deal of pressure. So I do think there's a role or opportunity to tie together a little bit better the experience of making decisions in an environment where you are denied good information, where you may even have erroneous information, where there are very hazardous consequences of being wrong, and yet where you have to make instant decisions. I think you can train people to perhaps do better in that environment.

Another area I would commend to you would be the use of simulation to select people who have a particular proficiency at the performing of some important function. The LAW, the light anti-tank weapon used by the Marines and the Army, is a weapon that takes a fair amount of skill to use it effectively. It was found that in the past, very often the LAW was sort of passed out within a squad to whoever happened to be handy. There were some tests run and it was found that there are a few people in each squad usually who are very good with the LAW, and a lot of people who are very poor with it. If you just know which ones are good and give them the LAW, you can triple the effectiveness of the LAW without buying any new ones or anything. It may be that through the use of simulation, you can sort out those people who are capable of performing these various missions.

I got interested in the question of identifying people who are particularly capable and what fraction of the things that are accomplished are attributable to a very small fraction of the people who participate. I noticed, for example, in one of the technical journals that I read - it's the Aeronautical Engineers Journal - I noticed the same names are in there all the

time writing these very fine technical articles on research that has been performed. The same people seem to be writing all the articles. Well, I made a plot, where I plotted the percent of the articles written against the percent of the contributors. Of course, on log paper, you get a nice straight line and you find that there's a major contribution or just a few people turn out all the good stuff. Then, I was watching Monday night football, and I noticed the same people were scoring all the touchdowns, so I got data on all the touchdowns scored rushing in the NFL and I plotted it on my plot of authors in the AIAA Journal, and the points fall right on top of the authors. It turns out authors and running backs have exactly the same contribution of productivity. I then got data on air-to-air combat victories for fighter pilots in the RAF - it falls on the same curve. People who got patents in my company - falls on the same curve as running backs and fighter pilots. Arrests by the Washington, DC police force - I got a data point not long ago on beer consumption and I can see from the reception this evening that this is a very highly contributing group here tonight. Just last week, I learned a very interesting thing. The JCS happened to have a copy of this; the Chairman was giving a speech about the contribution of people and he asked his staff to get data from each of the staff sections. This is a true story. The plot on my curve, the percentage of the staff actions handled by what percentage of the staff falls precisely on the same curve.

So you have this great contribution of people if you can just figure out which ones are the high contributors. It turns out that 10 percent of the people produce over one-third of the output. You can get rid of half the people and lose less than 20 percent of the output. That, of course, only counts those who really contribute something. There are all kinds of people who do things that are wrong and set all the rest of us back. It also points out that as you add people to accelerate a task, assuming that you had the good sense to put the best people on it to begin with, as you add people, the only thing you accomplish is to lower the average output.

If you're wondering what all this has to do with training, I think it maybe is suggestive that if you can find the high performers through simulation and help the others through training, it's probably money in the bank.

Another use, I think, for simulation - and much of simulation has been devoted to teaching skills - another important use might be to help determine what are important new capabilities, or what new system concepts make sense. How do you tie concepts and doctrine and tactics with new technology. How do you tie all those together? I had the occasion the other day to talk to Bob Herman, who was the Assistant Secretary of the Air Force and is now working in the USDRE, and he has been working on that idea. I mentioned to him that I was going to talk about this and he said, "I'd love to hear if anybody has any ideas

along that line, because I am thinking of starting a new technology thrust with a little money along those lines." So if all of you would line up at Bob Herman's office tomorrow, I'm sure he'd love to see you.

I talked earlier about the problem of not doing a lot of business if all your beers cost $4.75. There's another problem that's not unique to the training area but is important to it. And that is the matter of adhering to schedules. In 1798, Eli Whitney took a contract with the Continental Army to deliver 10,000 muskets and he promised in his contract to do that in 28 months. Actually he delivered them in 37 months. That's an overrun of one-third in time. I got data last year from all the System Acquisition Reports that the DOD gives to the Congress. It turns out that all of us in industry in the aggregate last year, our late delivery factor is one-third late, on the average. It hasn't changed since Eli Whitney. Some of the systems analysts tell me that it's not 1/3, it's actually 1/pi that we're late.

Now all this leads to one of Augustine's widely unremembered laws. One-third is like a physical constant when it deals with schedules. I call it the universal fantasy factor and the law goes as follows. It says that any given task can be completed in just one-third more time than is currently estimated. That's true. If you have ever worked in the Pentagon, you would encounter little vignettes like the following, and these are two true stories. I had one person once tell me, with some pride, "You know, this is the earliest we've ever been late." I had an executive from an aircraft engine company come to me once, an engine development that was in some serious trouble in terms of schedule and cost and technical parameters and a few other things, and the vice president of this company said that he didn't share my pessimism and, in fact, he felt that he could assure me of his confidence that they would have an engine there for the first flight. As Colonel Todd would certify, that was the only prediction that he made in the entire program that proved to be correct.

I got some data from the Air Force in preparation for this little talk tonight on the record of you folks in delivering simulators. You'll be happy to hear this. It turns out that on the average of all the simulators that I was able to get data on, you have delivered 35 percent, or just about one-third late. It turns out that 10 percent of them have been delivered on time and 20 percent have been delivered more than 100 percent late. So you're following the standard law that was established by Eli Whitney.

The fact is, though, that I think there is great promise in training and in the use of simulators to assist in training and in the other areas I mentioned. But I think we also are dealing with a situation where some of the problems that we're introducing in bringing these devices into reality, devices that

simulate with fidelity, devices that are affordable and reliable, that we deliver on time. Some of those problems are preventing our seeing them in wider use. One last story about an incident again here in Florida. There were two gentlemen on Miami Beach that ran into each other one afternoon, and they got to talking. It turned out they were both from New York. One asked the other how he happened to be there and he said, "It's a funny thing. I was in the furniture business in New York and I had a warehouse absolutely full of furniture but the styles had changed and I couldn't sell this furniture to save my soul. I was about to go broke and one day my warehouse caught on fire and burned to the ground and I collected the insurance and decided to retire here to Florida. I've been enjoying life on the beach ever since." The other man said, "That's an amazing story. I was in the simulator business up in New York, and I was stuck with this whole warehouse full of all these simulators packed with electronics and I couldn't sell a one of them. They were worthless. And an amazing thing happened to me, too. We were near a river and there was a terrible flood and wiped out my whole warehouse. And I, too, collected the insurance and have retired here to Florida." The first man looked at him and said, "How do you start a flood?" Well, one way to start a flood in the use of training aids, in my opinion, is to adhere more carefully to building things that we can afford, to delivering them on schedule, to be sure they do have good fidelity, and particularly to try to find a way where we can measure the pay-off of the simulator or the training device, because absent that, we'll always lose to the thing that shoots or flies or contributes in a more direct, measurable way to the outcome of the battle.

I admit, though, that there are some cases where training just flat isn't possible, where it doesn't work. One such case, I guess, I could relate to a story by Ilie Nastase, the tennis player. He was trying to teach his wife a form of discipline in her spending habits. It turned out his wife had lost her credit card and the credit card company discovered this, but the thing that amazed them was that it had been a full year from the time they figured out the credit card was stolen and they went to Nastase and asked him why he hadn't reported his wife's card had been stolen. His answer was, "Well, whoever has it is spending less than she was."

Thank you.

Mr. Merl

Norm, I'd like to thank you very much for a really superb address. You added a considerable amount of humor to a very serious message there. You've also convinced me to buy your book called "Augustine's Law" because I want to learn to tie a flea's legs. Also, I'm sure that the curve must be in there and there are a few people I'd like to plot on that curve.

DECEMBER 2, 1981

PANEL DISCUSSION

PROGRAM MANAGER SELECTION AND TRAINING

Introduction

The moderator for this panel, who is anxious to speak on the subject based upon a lot of first-hand experience, is Rear Admiral Duncan P. McGillivary. Admiral McGillivary is an Aviation Supply Officer and is currently in command of the Navy's Aviation Supply Office in Philadelphia. I'm sure that he has found the air to be very nice here in Florida, from his current post, and we'll try to keep the air that clean as we discuss a very sensitive subject called Program Management. I'm going to turn it over to Admiral McGillivary to introduce the panel, which he has assembled, of very senior management from both the military and from industry.

Admiral Duncan P. McGillivary

Good morning to you. If one were to accept as a given that the management of the Navy, at least for the Department of Defense in terms of Acquisition, is handled, at least in large cases, by Program Managers, and if you were to accept as a given that the development of equipment on the side of industry is handled by Program Managers, and that we ought to try and find a way to work as harmoniously as possible and to understand the differences between us in the way we do business, then I suppose this panel is a very proper and appropriate item, because we should try and work harder to together. There may or may not be some adversary relationships that are essential and necessary, but we ought to make sure that they are minimized as much as we can.

We do have a very distinguished panel. Mr. McAleer, who just addressed this group, is on the panel; Mr. Robert Mann of the Sperry Corporation, who has a very distinguished career in design, development, and management of very large projects; Dr. Hans Thamhain who has written extensively many, many articles and books on this subject and handled large multi-disciplinary type equipments, technology programs, and is currently teaching in academia on the subject; Colonel Bill Diesing, who has broad experience in the Air Force, both as a Project Manager in simulation and as a very well experienced combat pilot.

I get the job of defining Project or Program Management and I want to take a definition for this occasion that was, I thought, acceptable to the Department of Defense and certainly to the Navy. I have to emphasize Navy because that's where I've been most of my life and I'm kind of hide-bound in that respect. What the Navy does and what the other Services do is under the aegis, of course, of the Department of Defense. I define Project Management or Program Management, using those terms interchangeably, as a concept in which central authority is vested in a

single individual who is responsible for the planning, the directing, the controlling, the executing, the accounting for the definition, the development, the production and test of an approved project. Which says, one person responsible to plan, direct, control, execute, account for definition, development, production, and test of an approved project. In our business we say there are a few principles associated with that definition. One is, it involves intensified management. Secondly, at least for Navy, it has a development cost of $200 million or more; that is to say, if it does not have a development cost of $200 million or more, we will not place it under a Program Manager within the Navy. We say it must have production costs equal to or in excess of $1 billion dollars over the life of the production cycle or we will not have a Program Manager. We say that it must be a definable job with a beginning and an end; that is to say, at some time the Program Management shop should be dissolved when the project is finished. We say that it consists of urgent, complex technology. It has to be a tough job. We say, again, that there will be a single manager and we say that he will have authority for the technical aspects and authority over the resources assigned to him to do the job. We do, of course, as industry, use matrix management so those resources are constrained to that which is necessary. And it will include plant representatives and perhaps other persons spread out through the Navy establishment.

Within the Navy at least, under that kind of a guideline and qualification or quantification, we have today 63 Program Managers. These are all under the management essentially of the Chief of Naval Material, who directly manages eight of them. NAVAIR has 23, NAVELEX has 7, Naval Sea Systems Command has 25. The reason they are not all under NAVMAT directly - he only has 8 - is that the Navy tries to avoid layering - getting the Program Managers at the activity level, Systems Command, where most of the work is going to be done, recognizing that the Program Manager is going to cross organizational lines, working with OPNAV on the money aspects and working down in the organizations.

Of those 63, in order to whet the appetite of those assigned to it, several are Flag jobs and about 33 are classified as major command billets. That's because people like to get promoted and in the Navy, it's always helpful to have a major command if you want to get promoted. So there's a classification on it.

In terms of the number of people assigned to that, those 63 account for 520 some officers and 4,000 civilians. In terms of individual size of the projects, the single biggest one, the PM-1, which is the strategic systems project, has 70 military and about 2,000 civilians, and I found one I didn't know about called the PM-23, Theater Nuclear Warfare, which I'm hopelessly ill-advised about, which has 2 officers and no civilians - a Project Management team of just two people. So I have to presume that one is in the early stages of development and may or may not grow, or be flushed out as necessary over the life of that project.

In our Navy at least, and perhaps similarly in other places, the Chief of Naval Personnel develops the projects, defines them, and approves them, puts out guidance or an Instruction covering the project - what it's going to entail so we all can find it. He personally selects the Project Managers, issues their charters and he personally evaluates periodically their progress, and he negotiates whatever, if any, agreements with other Services regarding what's going to be done on that project if there is an overlap. So we put it under a four-star guidance and development. His real reason to do all this sort of thing is to make sure he has competent people assigned to the project. He spends most of the money and he has most of the resources in the Navy, at least for the Shore establishment, and then he uses matrix management for acquisition projects he wants to control.

The Program Management System in the Navy really was codified about 1976; all the Instructions date back to that time. There was a gestation period of about 18 months before then, but basically it started off at that time when he started designating Program Managers, setting them up - PM-1, PM-2, PM-3, on down the line. These people are backed up by the Weapon System Acquisition Manager Program, which started in about 1974, as I can best recall, and that was the process by which the Navy decided that in order to cope with acquisition, they had to identify officers that worked in that area, had some experience or skills in that area, some prior training, and to lay out for them a career program so they could evolve in that business and have two or three tours in the business, eventually becoming a Program Manager.

We have about 2,205 officers that are so designated today and each year there is a selection board that meets and identifies officers who have had some procurement experience, or for that matter, officers can apply to get in the program. Theoretically, they have a four-year tour. A Program Manager also has a four-year tour of duty. They have a four-year tour in the business, then they go out to sea or somewhere, come back and have a second tour in the business. In the process they get designated, if they are promoted, as a fully qualified Program Manager. So we have a journeyman and apprentice type thing, if you will, among our seniority with repeat tours and in the process, these officers are supposed to go to the school that you just heard addressed. That's one of the criteria for training and in the process of development, they are supposed to be brought along with several courses.

I went over the educational qualifications in terms of training of the 63 Program Managers we have to see if we'd really use the school that was addressed and there are several interesting aspects to it. First of all, of the Program Managers - there are 63 and there are 4 or 5 that are vacant - there are only 8 people in charge of those, usually Admirals, I might add, or very senior people, who have had no formalized training, like having been to the school. There are also 6 more of the Program Managers whose backgrounds I couldn't identify by the literature

to me, so perhaps they have something. But there are eight that are classified with no prior formalized training. All the Program Managers have Deputies. Most of the Deputies have been to the school. Not so many of the civilian Deputies, but most of the military. And then I took a look at how many Program Managers we have who had actually been to the school - there are four who have been to the full course and about three more who have been to the Executive Course, and the rest of them in various kinds of schools over time that would equip them to be Program Managers. So with the exception of 7 or 8 people, we have a formalized training program that works.

Lastly, before I introduce the speakers on the panel, I want to read to you some of the comments by the Chief of Naval Material to the Board that was selecting officers for this kind of assignment. And I want to read this to emphasize to you the seriousness of the Navy's intent to have the very best qualified people we can in this kind of business. This is what Admiral Williams said to the Board which just met and I shall read his comments. This is his instruction to the Board. I guess I should qualify it by saying instructions to Boards always read like everybody's a John Paul Jones, Jr. This is what he said. "Officers selected as these weapon systems acquisition managers should be competitive for assignment to our most demanding acquisition billet. By definition, these are the billets that 'clearly and directly' involve decision making that specifically affects performance, acquisition, delivery schedule, cost and operation, utilization of a weapon system specifically intended for Fleet use." That's out of one of his instructions. "These officers must be top performers with both the higher education and the current experience necessary to succeed in assignments such as Project Manager, Division Director, Business Financial Manager, or other key acquisition billet. Those you designate as Weapon System selectees" - and this is a board to select selectees who then go into the program - "should also be superior performers with both higher education and the capability of completing two solid acquisition-related tours by the time they become senior commanders. In those rare cases where a candidate" - and this is an escape clause, I'm sure - "in those rare cases where a candidate is a top performer but has not completed suitable higher education, recent and relevant acquisition experience may be weighed carefully as a potential trade-off." That says if you've got a super star, get him anyway. "Additionally, special consideration must be given to the operational demands on unrestricted line officers" - these are the ship drivers and the pilots - "which may have precluded gaining either higher education or sufficient depth of acquisition experience. To attain this goal, Fleet officers with high motivation and a demonstrated interest in systems acquisition must be given strong consideration for this designation - despite education or experience shortfalls." The heroes can get in there. "In all cases, the designation must be meaningful to the officer selected and his or her detailer and placement officer. Under no circumstances should one be designated if it appears that the officer considers the acquisition business simply a bail-out for a faltering work

or a specialty career. The caliber of officers selected by the FY 80 weapon system acquisition manager selection board has been demonstrated by the last Captain's selection board."

I'll summarize that by saying officers in the restricted line and unrestricted line community comprize, of those with these designations, 83 and 100 percent were promoted who were eligible for promotion, which is much higher than what normally would be accounted for. In the Supply Corps, 26 of those selected for promotion were designated. The Supply Corps is primarily interested in the business aspects of procurement, so we don't have any designation. It's not a condemnation on Supply Corps officers in this business.

"The Navy and the Naval Material Command rely on this annual board to identify our best qualified officers to fill these critical billets within the Navy's weapon system acquisition process. Your task," he tells the board, "is a challenging one. The results of your deliberations the next three weeks will go a long way toward determining the ultimate success of tomorrow's Navy. You are picking officers from whom will come many of our leaders for tomorrow's Navy, but most importantly, you are selecting the officers who will build tomorrow's Navy."

Those are comments by the Chief of Naval Personnel, which pretty well indicate, I think, his dedication to this particular program. With that kind of introduction and that kind of definition of what a Program Manager is in the Navy - or what we think it is - I'd like to introduce our first speaker. And his background is so interesting and so fascinating, and he's such a tremendous individual that I want to do it with some kind of care. And this is Mr. Robert Mann of the Sperry Corporation, the General Manager of the Simulation Systems Group. This young man has over 30 years experience in the design, development and management of military and industrial electronic systems; a retired Air Force officer, a private pilot and a licensed professional engineer. Major accomplishments include management of design and production integration of the HARPOON; ship command and lock systems; the integrated command display and control system for the Coast Guard's new cutter; the navigation and collision avoidance system for the U.S. Navy hydrofoils; the electronic sweep for the new Air Cushion Assault Craft; and numerous simulators and trainers currently in work at Sperry's facility in Fairfax, Virginia; and Army training devices in its Huntsville, Alabama plant. Publications include Ballistic Missile Inertial Guidance Support Systems; A Nuclear Reactor Rod Control Mechanism; and A Centralized ASW Weapon Control System for Surface Vessels. Mr. Mann joined Sperry in 1966, as Manager of Marine Computers and . . . Instrument Division. I'm very proud and very honored to introduce Mr. Mann to you, a very distinguished engineer, Program Manager, and all-around 18th Century philosopher. Mr. Mann.

Mr. Robert Mann

I'd like to thank the Admiral very much for referring to me as young, with all of that background. Admiral McGillivary had suggested that I address some of the differences or some of the relationships that occur between government program management and industry program management. But before that, I'd like to summarize and take from what the Admiral said about the formalized procedures for selection of Program Managers, and relate them to industry, where we go through quite similar processes but in perhaps a less formal manner.

I think that it is extremely difficult to introduce me as a spokesman for industry, since the practices are so diverse between the various companies and even within our own companies, various groups use different methods for selecting Program Managers. Usually the most important requirement is that the person be available. Unfortunately, that is a fact of life. However, we, and I believe most others, look for experience. That is the first criteria which I would look for in selecting a key Program Manager. We want to know what his track record has been; even if it has only been one prior program, you can examine his performance on that program and predict with a fair degree of certainty what his performance will be on a larger, more important program.

In addition, we like to select Program Managers whose backgrounds and experience mate or marry the program itself - the technology. It's not very wise to select a person who spent a lifetime in the hydraulics business and put him into some new EW communications operation where he has very little real basic knowledge of the equipment and the systems being developed. So we look for a marriage, obviously, between his or her technical background and the project at hand.

Also, we'd like to see a person with some seasoning in management and, by the way, you will all recognize - the project itself can range from some of the very small, important but nevertheless small ones, way up to a full-scale vehicle in which you might even form a total profit center, a division of a corporation, around and each one is called, in his own way, a Program Manager. Perhaps the Division Manager has some fancy titles attached to it, but nevertheless that's his job. He is a manager, a dedicated manager of that program. The factors remain essentially the same. His experience, his track record, his background in the technology, and his management development - the experience that he's attained over the years.

One very important factor which we sometimes don't address directly but nevertheless is there, we look for a person who we feel will obtain peer acceptance. The prosecution of any major project always requires interaction with other groups, many times with groups not directly under the control of the manager, and the ability of that manager to obtain the cooperation depends very heavily on the outcome, whether he's going to be successful.

In that vein, customer acceptance is very important. A person who has developed a reputation in the past with his customers for being a straight person and a person who is going to do his best to produce is very important in that selection. You certainly don't want a person who has repeatedly demonstrated an inability to get along with a customer, no matter who is right - he's wrong and you just can't afford that kind of thing.

Last on my list, but by no means last of criteria for acceptance, is the stability and tenure. In most companies within our industry, we like to select an individual who has been with the company for some period of time, who has a stake in the company, if you will, and a person over whom guys like me have some control. We don't want a fellow who is just as likely to jump out when the going gets tough and leave us with a big bag of you-know-what.

In general, I would like to have a person who has a minimum of 5 to 10 years in our own organization, who has developed not only the peer relationships but the so-called handcuffs that tend to tie him to the company. Once we've selected this individual, and industry, I think, is not much different from the Services, we continue to emphasize the person's development, his training, and we do it by a number of means, fairly common, I think, although the names are different. We in Sperry have a system of tracking an individual called a Management Development Record, and I guess most of us have something quite similar in which we annually follow the man's progress or woman's progress through the chain of command up the career ladder, and we do pay particular attention to our key program management people. It's quite common, of course, to handle the person's annual review with an appraisal of how well he's doing, where the strengths are, where the weaknesses are, what development needs are, and I think that that would be quite common in parallel with the Services.

Most companies have developed over the years, and we at Sperry have, starting at least a dozen years ago, developed a series of management training courses, seminars, conferences and what-not. Some of these are in-house. Many of these are directed out of house training operations, in which we attempt to keep our people up to the state-of-the-art in management techniques. Certainly in recent years we've had to emphasize asset management - it's become quite important with the high interest rate problems; an asset sets there and it's really costing a lot of money and unless you're managing it properly, it's detracting from whatever you're getting on the contract. Program Managers don't inherently know this. They have to be told what it is to look out for.

I could continue on. We have approximately 10 or 11 formalized courses in this series dealing with interpersonal relationships, communications skills, asset management, and so on and so forth, and all of these are given on a routine repeat schedule and our program management people, among others, are normally cycled through the series of training. And of course, last but not least, the training that you might call on-the-job training in our company and in many others that I know of, the process of

reviewing a particular program on a monthly or quarterly basis - sometimes even on a weekly basis - has now been generally reduced to a formalized system of specific key performance measurement points in which I or my subordinates sit down and go over these points of productivity, progress, and how well we're doing against our commitments on these regular bases. This is essentially development on a continuing basis, development of the manager himself.

I might be taking a little more time than I had planned, Admiral, but it was suggested that I might just address the topic of the relationship of an industry Program Manager to a government Program Manager, and when that topic was first broached to me I admit that the first word that came to mind was "adversary." That seems to be the relationship that develops very quickly between government and industry, once the contract is signed and everybody gets down to work. And yet, there's no logical reason why this should be so. The objectives, obviously, are the same. We most often have a common customer; the government Program Manager has to satisfy a user, and, of course, so does industry. We both have as a primary objective to deliver the product the way it is supposed to work so that the user is happy with it, within cost and certainly on time within schedule.

Unfortunately, though, there are differences in the type of work that a government Program Manager does and one that an industry Program Manager does. The resources, for example; in industry, a typical Program Manager will have at his disposal the engineering function, manufacturing functions, purchasing in many cases, contracting or legal, and a number of other functions having to do with the producers which report directly to him and he is responsible for giving the direction, guidance, and so forth that these producers respond to. In the Services, while I'm not familiar with all of the 68 different Program Managers and what they do, generally the Government Program Manager has a much larger scale and scope of work, but does not have all of these "do-ability" type people working for him. He has the kind of people who monitor and direct, but do not get the direct output relationship. And so they have a considerably different way in their day-to-day processing of the work. Sometimes the adversarial relationship develops because the government Program Manager - this concerns a lower level person - does not have the ability to communicate directly. He often has to go through the Contracting Officer and the Contracting Officer becomes the spokesman for the customer, rather than the Program Manager. And so there are sometimes difficulties there because the same communications don't come down through the multiple channels.

And lastly, of course, there is always the element of distance. The Government Program Manager and his relationship with the industry fellow is one at arms length. They're at a distance and they can't see each other more frequently than once a month or something like that. So there tends to be problems develop - basically communications type problem, not one where differences of philosophy are paramount.

I guess we can debate that topic more extensively as a part of the question and answer period. I don't have any panaceas for resolution of these problems, other than to acknowledge that they do exist. Perhaps Mr. Farmer could comment on that later on. He has broader experience than I, I believe, in the selection and training of Program Managers.

Admiral McGillivary

The second speaker is Colonel Bill Diesing, United States Air Force. What makes Bill Diesing interesting to everyone here is that he is the Assistant Deputy for Simulators, Headquarters, Aeronautical Systems Division of the Air Force. He has a Master of Science in Engineering Management; he has worked in electronics and maintenance; he has been a Program Manager; he has worked as an Operations Analyst in the Office of Operations Analysis; he has worked for the Assistant Chief of Staff for Studies and Analysis - many tours in that area; he was the Program Manager for the B-52 KC-135 weapon system trainer, Headquarters, Aeronautical Systems Division, Wright Patterson. The Air Force always has these long titles. Two years after the design of the trainer, he became the Director of the Weapon Systems Program of the Simulator Program Office, which means he was a successful Program Manager. He knows the business of Simulation; he knows the business of training; he knows engineering; he knows maintenance; he knows avionics, electronics. Colonel Diesing.

Colonel William Diesing, Jr.

That was a super introduction, Admiral. Only one problem - I don't fly.

Today I want to get into a little more of the trenches of the basic subject today. Philosophically, we in the Air Force agree with the Navy and some of the remarks Mr. Mann made about the criteria. A little clarification on terms. When the Admiral speaks about Program Managers, that's equivalent in the Air Force to what we call Program Directors. Some of you may know people like General Monahan, who is the F-16 Program Director, General Chubb, General Thurman, who is now the B-1 Program Director. When we speak of Program Managers, we're speaking of guys that would be the equivalent in the Navy, I guess, Project Managers. These are guys that are managing programs anywhere from the million dollar up to the $7 and $8-million dollar size, rather than some of these billions of dollar programs.

What I want to talk about today, primarily, is the people. I'm going to talk a couple of indentures down from the previous two speakers. I want to talk about what we do in the Simulator SPO, and give you a feel for the kind of people that the majority of you who have business with the Simulator SPO are dealing with, and what their backgrounds are and where they're coming from and how are they trained and what we're doing to improve their capabilities to manage programs.

I had some conversations on this general subject a couple of weeks ago with one of our contractors. And out of that conversation, I guess the conclusion was that we do a super job of putting training equipment out in the field to train combat pilots and so forth, but we don't do a very good job of training our own people to acquire this equipment. Now in the SPO, and I'm talking about a SPO (System Program Office) of about 200 or 300 people up there at Wright-Patterson. There are a number of ways that we get people and I won't use the word "select," because we don't select. We sure would like to, but we don't select. The system, with the manning levels and so forth as they are these days, just doesn't allow that opportunity. But essentially, in agreement with Mr. Mann, we like to get the people who have had previous experience, Program Managers - majors, lieutenant colonels - who have managed one or two programs. I'd say in the SPO right now, we maybe have two of three of those guys in program management slots. Taking that a little farther, if you can't get those guys, you try to get someone with some Air Force experience, or a graduate of DSMC and not all those who come out of DSMC have had previous program management experience. We get some of these. In fact, right now I think we have five DSMC graduates, PMC course, in the whole SPO.

There is also another source, but this is just a very small source, and this is cross-training programs. You bring pilots in. The Air Force Institute of Technology up the hill from us offers a course of about a month or six weeks - takes pilots, navigators, people out of the flying jobs, and gives a quick crash course in program management and then you try to grab one of these fellows.

But in this day, the preponderance of people that we are getting, that are made available to us, are second lieutenants right out of college - no training. Biologists, chemical engineers, degrees in history - and this is the material that we on the SPO are getting. In fact, right now in our military manning, the SPO is made up with 40 percent of these people.

Needless to say, that creates a need for a good, strong training program. It hasn't always been this way. This phenomena has only happened in the last two or three years, that we've started getting all these young lieutenants out of school. There is a very small cadre that we get that are former enlisted men. I think we have two of these guys in the SPO right now. They take very little training because they're pretty well up to speed when they come in. But all these lieutenants coming in precipitated a need for us in the SPO to induce a framework and a structure into an already existing training program, albeit it wasn't really exercised, and didn't need to be to the great extent it needs to now. So, back in early 1980, we developed what we call a training plan for various specialties within the Program Office - Program Managers, of course, Configuration Managers, Secretaries. What we did was to develop one of these plans for every individual in the Program Office, and also designated a Training Monitor in the Program Office to kind of give us policy on how the training should be done and also to update the plans and so forth.

Let me take the Program Management Plan, for example. We get a young second lieutenant in. First of all, we assign him a sponsor in the organization that he is going to be working with, and the lieutenant more or less shadows this individual around. We have a series of briefings that our Directors give on a periodic basis that familiarize the individuals with the organization and how we operate. As most of you know, in the R&D business, there's a big nomenclature problem - CDRL, RFP, so on and so forth. You have to get right down to the very basics. Anyway, in these plans we also have laid out operational instructions, OIs, and things of that sort which they have to go through. We put them in a training program where they have to shadow someone who already has a program for at least a year or more before we will really let them on the loose to manage a program of their own. There are exceptions to this. We have one or two of those in the SPO right now, but in the main, you'll see some of our Program Managers come to your organization dragging along a couple of second lieutenants. It's just part of the training program.

Also available to us in the SPO are courses like the DSMC course. Even though we don't get too many opportunities to send people to that, maybe one person a year out of the whole SPO - that's not much out of an organization of 300 people - we have schools up at the Air Force Institute of Technology, but in the main, the best training is the OJT that they get flying cover on one of our assigned Program Managers.

People ask how we enforce this thing. As I mentioned earlier, we have a Training Monitor in the SPO and really it's not a monitor, it's someone who helps maintain the records and gives us policy. But Monitors are the direct supervisors of those individuals and they have a continuing responsibility to review the training plans and make sure that the individual is making progress. Those Directors have to report to me or to Colonel Reddenbacher, the SPO Director, on a monthly basis. That is the control that we put in to make sure that there is progress being made.

The other day, Admiral McGillivary was talking to me and he asked how we certify these people. I thought a minute and then I said, "Gee, we don't certify." You heard him speak and you know that there is more or less a certification - the Navy puts a Good Housekeeping Seal of Approval on their Program Managers and so forth. Well, we really don't have such a formalized system at the level that I'm talking about. As I think of it, I don't think we really have one at the Program Director level. But in the Air Force, I guess the closest thing that comes to certification is that in the Air Force you have an Air Force Specialty Code. Well, I looked up the requirements of the Air Force Specialty Code for Program Managers. The only firm requirement is that he has to be on the job for 18 months and he should go to DSMC or one of these formal schools. Then I thought about what we do in the SPO. Well, we usually keep the person on the job for 18 months before we upgrade his specialty code. Now, do we send them to school? Heck, no.

We can't get those spaces. There just aren't enough around. So what do we do? We send in a waiver. So the only certification they really have is just the time on the job.

But needless to say, the system is working, as some of you can attest. They aren't doing a bad job. There has to be more structure in the system. The sorry thing about getting all these new young people in the Air Force - if they're going to be a Supply Officer, they go to a formal Supply School and get all pumped up from that; if they're going to be a pilot, they go to pilot training. Program Management? They're just thrown into the SPO and the SPO has to train them. So, with all these lieutenants, there is some good and some bad news. I guess the bottom line, as I mentioned, is that there is no formalized method of training and maybe with the lieutenants coming in as they are, this will precipitate a need for some formalized structure like a supply school or something like that. It really works a burden on the Program Office. The Program Office not only has to run programs, they are also running training programs now, to a large extent. And it draws down on the limited resources of the SPO to train these folks. On the good side, though, we have so many coming in that we're building a fantastic cadre of Program Managers for future years. In five or ten years, the Air Force is, I think, going to have a great deal of strength in the program management area. I must say, this lieutenant problem, can or can not be a problem. It does not only apply to the simulator scope, it applies to all the Air Force Program Offices.

Admiral McGillivary

In introducing Bill, I could have said that he is a graduate of Annapolis, but I had a hard time getting that one out. Just want to get the record clear.

Our next speaker is Dr. Hans Thamhain. He's been responsible for management in many very large, multi-disciplinary, highly technological programs. He has 15 years experience with Project Manager positions with ITT, Westinghouse, General Electric, and GTE. He has degrees from three nations: Germany, Canada, and a Master's and Doctorate from Syracuse University. He has written two books and about fifty articles on the subject of Engineering Project Management. I don't know anyone more qualified to talk about it than Dr. Hans Thamhain.

Dr. Hans Thamhain

The selection of Program Managers is very crucial to the success of programs. I don't have to stress that factor. It's clear to all of us. It the question, what do we do about it? I think from the prior three introductions on the subject, it's clear that the selection processes need to be processed by the identification of good program managers, the cultivation of these people, the training, and finally, selection.

What I'd like to do as a kind of introduction to the panel discussion on my part, is to share with you some of the findings that I have from my own experience in industry as a Program Manager, as a manager of programs, some of the findings that make certain criteria that make good Program Managers so uncommonly successful. What are these commonalities?

I've brought two slides with me which I would like to show you. The first one is really based on the experiential. The second one is a little bit of research on skill requirements.

Sitting back after about 15 years of experience on the job, I wanted to put something together I can show to my people and say, "Here's what I feel are the qualifications of a good Program Manager. Here's what you have to go after." The thing is colored from the industrial point of view. Program Managers in industry normally are handling smaller jobs in terms of dollars than what you just learned from the Services - in order to qualify for a Program Management job, $1 billion dollars life cycle cost is much higher than what we see in industry, where a Program Manager might be called a major Program Manager with a $10 million program. But many of these things apply to both sides. Let me just discuss it a little bit.

These are what I call common characteristics that make good Program Managers so uncommonly successful. The first thing, and it's kind of interesting and I put it here first, and both Mr. Mann and Colonel Diesing mentioned first in their speeches, and that's prior task management experience. How can we find the Program Managers if they need to have program management experience in the first place? It sounds like the chicken and egg situation here. What I mean by prior task management experience is that we have maybe a luxury in program management to test out people - whether they really like it, they really qualify, how well they're doing - without really appointing somebody to be a Program Manager the first time around. Maybe we can give people task management exposure on a shorter time job, on a smaller type job, and see how that person does, and let that person work with some other more senior people. At least in my involvements, these were possibilities. We didn't have to promote somebody from senior engineer to program management. The person could function as a Task Manager, as a Project Engineer, with the same qualifications that it really takes to manager a large program but on a smaller scale. The prior task management experience, in my own judgement, is probably the most important thing that is necessary for qualification of a good Program Manager. The past is a good model for the future.

Program Managers need to have administrative skills and these are things that are easy to come by. It's not difficult to teach engineers how to do budgeting, how to do scheduling. But they are necessary, because otherwise they get kind of caught in their own underwear, in red tape, and it makes the job very frustrating.

The third on the list is an understanding of the technology. I've had some very interesting discussions prior to this meeting. The thing that's shared by most of us in high technology or technology type fields is that unless the Program Manager has an understanding of the technology that he or she is managing, unless he has an overview of what is really involved in building that simulator and what techniques are involved, unless he has an appreciation of the application itself and knows the customer community, unless he has all these ingredients it's very difficult really to manage an overall program. I have seen many times that the Program Manager doesn't really have the technical understanding of the program. What's happening is you might have a deputy called the Technical Director, and every time a critical question comes up the Program Manager turns to the Technical Director and says, "John, what would you think about this? How would you make the selection?" If you delegate these technical decisions down to the next level to somebody else, then you're really not in command. You're not really in charge of that program. That's my feeling. So I think it takes an understanding of the technology itself in order to manage a program, manage the technology. Unless you have that understanding, you really can't participate in decision-making, in the tradeoffs, in helping to find solutions, predicting problems, in predicting how a small problem might develop into a big one and do something about it. Now, understanding technology doesn't mean that you have to have a Master's degree in engineering, necessarily. I have seen many people who came the administrative route who became excellent Program Managers. But it means understanding the overall technology. You can acquire this knowledge, as you all know, from a little reading, a little studying, and on the job.

Planning skills are important. By planning skills, I don't necessarily mean going off in the corner and writing a schedule. But doing those things that it takes to put the time together and put the plan together - the involvement with others - knowing how to get commitments - knowing what is possible and what is not - working with people. That's what I call planning skills.

Leadership. That's a big, mystical term. Everybody talks about leadership. What we mean by leadership in program management is the ability to direct and lead people, people in many different disciplines over whom we might have little or no authority. Forming teams - being able to plan and direct people - being able to formulate common goals - creating visibility - treating people right in terms of their own career objectives - making sure that there is work challenge, there is interesting work and juggling things a little bit so as to form a team that really works for common objectives. All these things go into leadership. When we analyze what leadership is, there is a long list of things and most of the other topics are overlapping. Particularly the understanding of technology. I think somebody who has a good understanding of technology probably is being perceived as a strong leader, because he or she can really participate in the technical decision-making processes.

Interpersonal skills, the knowing of what is important to the people - knowing how to turn people on - finding out what makes them tick. I think this is important in program management. We talk about productivity in many areas, including engineering, and it's very difficult really to measure productivity. If someone has a considerable pile of papers for weeks, we don't know if that person is contributing or not contributing.

Being sure that the person likes what he or she is doing is important. During selection interviews up front, when people are being chosen or selected for a job of a Program Manager, I think it is important that the superior or whoever they are reporting to is getting a good feeling what the person can contribute, on one side, and what is being expected from that person, on the other side. By what is he or she being measured at the end of a job. The selection interview, I think, should go down to any level. The Program Manager should perform that same interview with his or her people. The Task Manager should do the same thing.

Team building capability. Again, that's a big term. Everyone talks about team building. What's involved? Well, I think again, an understanding of the personalities of the people, as well as an understanding of the organization that you build these teams in. I feel a Program Manager has to be kind of a social architect. He has to know how the organization works and how to work with the organization. He has to know the value systems of the organization. And I think that as Program Managers, we have to build teams not only in our little microcosm, our own organization, but across our own organization. If we are industry, we have to build the team out a little bit in the customer community. If we have subcontractors, we have to build teams there. It takes an understanding of organizations to do this.

The last item on here is credibility with the customer. I think that came up before that unless you have the credibility to the customer, it's very difficult to do business with the customer community. Credibility comes from the image of a sound decision-maker. Probably understanding of the technology is another important element.

I have two other items scribbled down here from a previous discussion. The ability to grow with the assignment apparently is another ingredient that helps the Program Manager to grow more than anything else. The ability to identify new business might be another important ingredient. But these things are afterthoughts that came up and I left them on here for discussion.

So coming back, with that kind of introduction saying that these are the qualifications of a good Program Manager, maybe there is not that much argument about it. But what are we going to do to select them? I don't have any secret formula for this. But I feel tracking people and their interests is up front one of the most important things. If you don't know who is interested in becoming a Program Manager, it's fruitless to select people from those who

don't want to be Program Managers. So tracking people, I think, is important. Giving people the opportunity to do a program management type job, selecting people from the engineering community and those who have the interest, given the opportunity to work for the Program Officer. Evaluate these people properly. Encourage them. And from an organizational point of view, make a little investment. It's tempting to use only the seniors. If there's a new program coming up, you ask who is the best person or the best people to run it. But if you want to train people, you have to bring them up. There's an old saying in college football, you cannot have only the seniors playing because one day they will graduate and you won't have them anymore. So you have to bring people up.

Whether you have a formal system or an informal system, you have to have a system that works in this line. I believe in formal training through schooling and seminars to augment the process of training. But I think there is no substitute for on-the-job training. It's a difference between knowledge and skills. What you do in schools is develop knowledge; what you do on the job is translated from knowledge to skills.

Maybe I've said enough so we should leave a little bit of room for discussion. But maybe for openers, there are my thoughts. Thank you very much.

<u>Admiral McGillivary</u>

Thank you, Doctor.

Before the panel opens for discussion, I want to ask Mr. McAleer, who has been sitting here very patiently from the previous address, if he wants to make any comments.

<u>Mr. McAleer</u>

Admiral, let me just make one right from here. In listening to these gentlemen with regard to the various attributes a Program Manager must have, and where I'm coming from, the point I would make is that a Program Manager must be likened to a lawyer. He must understand the overall process. If you're narrowly segmented and cannot anticipate what is coming down the pike, and that's from either the industry side or the Government side, I think that's where we find, on both sides, Program Managers and their programs getting into trouble. So the thing we try - and I covered before in my short talk in the prior period - at the Management College, is providing Program Managers, through a content-driven course as opposed to a skill-related course, what is this acquisition process all about. And we take 20 weeks to do it.

<u>Admiral McGillivary</u>

Are there any questions?

Question

The panel members addressed themselves to the dangers of OJT.

Mr. Mann

Unfortunately, you at times must live with them. The tighter the rein you put on a designated Program Manager, the more difficult it becomes for him to actually grow into the job and to manage the job. Yet with a relatively inexperienced person, we cannot give him on day one all that wonderful authority for him to use and possibly abuse. And so there is a trade-off where each different Program Manager, different level of program management, has to be carefully reviewed for the correct balance of authority with which you endear him. Now, there is no way in our business that you can avoid disasters or mistakes. And when you're giving a fellow on-the-job training, you're automatically saying go explore some unexplored things that you haven't been through. We cannot monitor these people hourly or daily and make all their decisions for them. We have to let them go off on their own. The best we can do is the regular periodic review of the key elements of his job. He will make small mistakes; hopefully, we'll prevent him from making the bigger ones. Yes, there is that problem.

Dr. Thamhain

One other comment on one of the dangers - it never occurred to me that there might be a danger, but since you brought up the question, I think there is. And that is in an involvement where they don't have the expertise and you try to train someone on the job within a team that is inexperienced, they might learn the wrong thing. Since the team now developed some sort of spirit and pervasiveness and they all believe they do the right thing, but really do the wrong thing, I have seen that happen. With regard to overcoming that particular danger, I think schooling is an excellent vehicle. Get everyone on a common ground and say that this is what we're supposed to do - let's see whether we can really implement it, rather than let people fight the fires; in the daily process, it's very tempting to take shortcuts and do the wrong thing. In the end, everyone says, "we succeeded, so we must have done something right."

Admiral McGillivary

One of the things we wanted to probe, of course, was what, if anything, we could do to improve the harmony between the Government Program Managers, Contract Administrators, and those in industry. I guess what the conference talks about is trying to find a way to develop Program Managers that can talk to each other, can work effectively through a selection process on both sides and the training process on both sides that is oriented about the same way. Let me ask Mr. McAleer - do you think we are training the same direction? Are we training farther apart or getting closer?

Mr. McAleer

Let me just take the thing that was rolling through my mind with regard to that, the question or the point has come up - the adversarial factor with regard to government and industry. And I think of the current Administration, with the Carlucci initiatives, the Carlucci actions, the Defense Acquisition Improvement Program. The first of the 32 items, number 1 of the 8 or 9 principles there very specifically addresses that particular point and I think it was made mention of yesterday. The fact that the adversarial relationship between government and industry, as if by a switch, it will be done away with. My thought on that - the point that Mr. Carlucci makes in saying that is that other than at the negotiating table when there is to be an arm's length relationship between government and industry, which is most appropriate, that at the other times it is to be a team action, because as you well know in this business, if government and industry do not play together or work together, the end product can be a disaster. So I tie that back to the Admiral's question with regard to the training to get to that common point, and I was sharing this with some of my colleagues at the table. We have 10 percent of the individuals coming to the Management College are industry, and working in 25-person sections, 2 or 3 representatives of industry and some 22 from government, it is amazing what the government people learn from their industry associates and some of the misconceptions we in government have about how industry operates. The industry students are not quiet about bringing up discrepancies when a military or civilian government student would bring up what he thinks. That industry representative says, "Hell, no. Let me tell you how it really works." In our small way, we're getting, we think, a little bit closer in dove-tailing our collective operations through training.

Admiral McGillivary

Am I to read from that the you think one of the best ways to do the job is to have them train together? Is that what I read from your comments? And I also would read, if that's true, that your training together is miniscule in terms of the universe.

Mr. McAleer

Yes.

Admiral McGillivary

Then we can't get there.

Mr. McAleer

Very quick to agree with your second point that although we feel we have an excellent training program, I think Colonel Diesing brought up very specifically that we can't cover the waterfront. We're serving a very small percentage of the population.

But yes, I do think this training together has, from our point of view, achieved some tremendous benefits.

Question

From a practical side, and speaking only to the Air Force, which is the only organization I have experience with, and addressing Mr. Mann, I represent a small aerospace firm and we train pretty much the same way you do. We wouldn't have a Program Manager who didn't have at least 5 or maybe 10 years experience. That gentleman, if he performs, is assigned throughout the duration of the program. We have a little difficulty in our Air Force customer where we might, through the course of the program, come across 4 or 5 different Program Managers during that period. Is there any attempt on the part of the Services to sort of carve out this specialty and say that this individual will be responsible for the system from the cradle to the grave?

Admiral McGillivary

Not in the Navy.

Colonel Diesing

Let me make a few comments on that. It seems to me that with Mr. Packard's initiatives back a number of years ago in 5000.1, it said Program Managers will stay on until they reach a particular phase point in the program. Now, you may be seeing some of this phenomena, but I strongly suspect with the passage of time that that is no longer the case. I think what you're seeing is the phenomena of the military transfer and assignment system and again, I guess I'm less inclined to deal in the philosophical world and to deal more in the real world, because that's what I deal in daily in my business. Philosophically, I support a Program Manager being on the program right from its inception right through developing of the RFP, letting the contract, right through program management, responsibility transfer, but the system as it exists today will just not allow that. Regardless of what everybody's saying, the Air Force personnel system does not support that. In your Program Directors, now, and these are the people that I'm talking about - I don't know if we have 80 plus like the Navy has - but at those very high levels, those officers are probably transferred at clear-cut phase points. But in the simulator world, of which I speak, a guy comes up for a school assignment or something, and regardless of where you are in the phase of the program, the man will leave. So here you are, grabbing around trying to find someone else to throw in the gap. We face this daily and I don't see any relief from that.

I wanted to comment on this adversarial situation with the contractor. Back down to the SPO level, the feeling is on that, there will not be an adversarial relationship with the contractor if you each have credibility with each other. The best way to have credibility is to have an understanding. One of the attributes

of a Program Manager is communication, being able to articulate what his requirements are and the second part of that communication is being able to sit and listen - and I mean listen - and hear what the contractor is saying and understanding it. I think more will go to getting us out of this adversarial relationship down at the Program Manager level in the Air Force if there is more of that done.

Admiral McGillivary

We have time for one more question.

Question

I'd like to address the panel on a couple of things. All through this conference I've heard a great deal about the need for military/industry cooperation. I also heard about a number of topics about the support contractor role. There is a tremendous amount of distinguished program management capability in industry. Is there or has there ever been a program of manager exchanges, that is, the military man serving a time in an industrial position and the industrial manager maybe serving a time in the military under a contract or perhaps just an exchange program? Also, would the military services ever contract out at the program management level? These exchanges are, I think, very valuable, as evidenced by Mr. McAleer's discussions earlier on the training together with military and industry at the Defense Systems Management College. From my experience there, the greatest thing that happens in that exchange of information is their policy of non-attribution, where one can really exchange opinions and have some real first-hand discussions. Now, this could happen very nicely if there were programs of exchanges where the military and industry people could really work together first-hand on a program at the very highest level. Will you comment, please?

Mr. Mann

I believe we've had in our company exchange students. I recall several years ago we had a couple of Air Force officers who served with us for a period of 3 to 5 months. These were bright young fellows, I think at captain or major level, who were getting a revelation as to how industry really works. I don't recall any similar or reverse operations with industry executives serving with the military, although we have, on many occasions, worked very closely over periods of time, on a non-contractual basis with our counterparts. It does serve as an excellent communications media and you can let your hair down. It is amazing how many military people, when they finally learn about how industry really works, are quite surprised - "Gee, it's quite logical. You guys aren't that bad at all." And I think the solution to the adversary problem, if there is one, can only be accomplished through the communications process. Let your hair down. We're not trying to pull the wool over anyone's eyes. Well, we have problems, but every program has problems. Unfortunately, they're the same ones - they just keep repeating.

Mr. Farmer

I think our time has expired. I'd like to lead the applause for our panel. Thank you all very much. Thank you all for joining with us. It was very difficult for me to stay out of that conversation and I'm going to insist that next year we have a similar subject so that I can participate directly in it.

NAVY USER PANEL DISCUSSION

Introduction

The Moderator for this discussion will be Admiral Hogan, who addressed us Monday morning and he will introduce the members of his panel.

Admiral E. J. Hogan

Thank you. I'm glad to see as many smiling faces as we have this morning. We're going to just leave the floor open to you guys. We're not here to lecture. None of us are quite as quick with bear stories as Norm Augustine, so we can't tell jokes. So I'm going to introduce some people with whom, hopefully, you will have a little interaction with so that we don't all sit here and look at each other. Because if that starts happening, the session is going to close very quickly.

I think you probably know most of the people up here. On my far left is Jim Bolwerk. He's from San Diego in NAVAIRPAC and he's been in the training business to varying degrees over the years. I've known Jim, flown with him, and we go back a long time.

On his left is Dr. Jim Henris, who is in the surface side of the house. He's actually here at Orlando and he represents the OP-39 people in the Pentagon, as far as this panel goes.

On my immediate left is Dan Desko, who works for me in the Pentagon in the Trainer Maintenance and Procurement side and he has a lot of expertise in this area, so he'll be fielding quite a few questions.

On my right is Dr. Jim Harvey, who you've all heard speak. He is the Technical Director at NTEC, again a very well-qualified man to answer those kind of technical questions.

On his right is another old running mate of mine, Captain Bob Glaves, who is the Atlantic Fleet rep at FASO/LANT.

On the far right is LCDR Bruce Lemkin, representing our submarine force.

So without further ado, has anybody got any questions out there? The clock is running.

Question

(The question cannot be understood)

Admiral Hogan

Let me start that one off, because this is one of the conceptual things that I've been trying to push here the last few years in the United States Navy, and of course, in my particular area of aviation training.

I think Mr. Augustine alluded to it last night on how really screwed up we are in the instability of our people, and how often we move them around and how much we have to retrain and redo the things over and over again. If you took a real step back, again from a conceptual point of view, and tried to run a business that way, you'd go broke. It's flat stupid. But we do it for other reasons than just for readiness and training. There's a system of concepts that keep people in the Navy by doing these sorts of things in a sea/shore rotation.

One of the things we're trying to do here in the last four years in several ways - some of them more direct than others - is trying to get the sea duty side of the Navy recognized for what it is. We all know what it is - it's very tough, hard, demanding, arduous, hazardous work and the way you compensate people for doing that is you pay them. One of our big initiatives over the last several years in which we've been successful, and has done very well with the Congress, is the initiatives on sea pay, on responsibility pay, and to a degree on tying some of our bonus incentives to people to go to sea and do the hard job and pay them to do it, and keep that skill and experience level out there. It makes an awful lot of sense if we can do that and train the crew one time, rather than have to train four or five different crews between an overhaul cycle. It sure makes the training job a lot easier. When I was Commanding Officer of the Kitty Hawk, I had a turnover on that ship of roughly 50 percent at the minimum. It was actually greater than that. So every other year, I had to train a whole crew. That's stupid. I'm talking to myself when I say that, because I'm the part of the system that has caused this to happen. We're trying to figure out a way so we do not have to do that in the future.

So I guess after that little bit of a preamble here, the kinds of things that you're referring to are, in essence, how do you bring the schoolhouse to the ship and what kind of training concepts do you use to sustain that. I think you people in this audience and what we've seen here today offer us a great chance here in trying to make the things that we use in the schoolhouse the same as the things we use on the ship. By using the data processing system, the data information system, the retrieval

systems and the like, so we have one set of documentation that teaches the guy how to do something, teaches him how to do it in a way that is easy and has a lot of training effectiveness to it, and it's that same information base that he uses to operate and maintain equipment. The procedures are in there and you're using the same music across the board. And it's available and it's understandable - I'm talking in this regard to technical manuals and the like - up through the gamut of the kind of things that we do in the tactics training, in the team training operations across the board there. There's an awful lot of opportunity in this area. We're got a project that I'm trying to get underway and I have a unique opportunity with a Captain Dick Martin who is the prospective C.O. on the Carl Vinson. He is sort of in the same vein that I've just talked about here and I understand the job that he has to run that big ship from its nuclear propulsion plant to all its warfare areas. He's trying to put this together in a coherent sense. We're starting to make some moves in this thing. In essence, it's to get the information that we need, the knowledge factors, putting them together so that they are accessible and available and they're easy to get into from all levels, and get that information so it's there. You're buying the knowledge and experience of the predecessors in those equipments and putting them together, and there is going to be - maybe not in a simulation sense that we think of in flying machines - but simulation in terms of video displays and the like. I think there's a lot of opportunity out there, again, for a total system concept and that's really the message that I'm trying to bring down here to this meeting.

Dr. Henris

From the surface side, I think you addressed several questions which I will try to respond to.

Number one, we're not going aboard with basic operator training. What we are finding, though, is that once we have trained the basic operator in such things as passive . . . analysis, the skills are very perishable. He gets onboard and within a matter of weeks, he has forgotten many of the things he needs to know. So what we're planning to go onboard with is some advance refresher type training for our operators.

Beyond that, in the area of sub-team training, you mentioned cost effectiveness. In truth, it seems to be working the other way. With the numbers of classes of ships that we've got in the surface Navy, and the unique combinations of fire control, sonar, and radar, each one of those ships classes is totally different. In order to do effective shore training, our training complexes are now talking in the matter of 20 to 30 mock-ups for the various CICs, for the various ships, and every one of those mock-ups is basically GFE, operation equipment. The overall cost of that is mind boggling. So one of the reasons we are going onboard is to do more of that team training onboard the ship and get away from the need for all of those mock-ups in all of those home ports.

Once again, though, basic team training is going to have to be done on shore because you, at that point, don't have a coherent ship's crew. What we want to do onboard the ship is refresh the individual so they can retain their basic skills, and give the actual ship's team practice working together, because once they are assigned to a ship, getting them to an ashore trainer becomes a big problem. You're talking about your key operating personnel, starting with your Commanding Officer, and yes, in the past it's been very difficult to get a Commanding Officer in there and tell him he wasn't doing it right. But that is where we're headed, because the key man in this whole problem in the Commanding Officer and it's not a matter of telling him right or wrong, it's a matter of coaching him so he can use his weapon system.

Dr. Harvey

I think there are a number of different ways you can approach this problem. One is the way in which Jim just mentioned, where you tend to have some kind of embedded mode within the system to maintain the skills of the operators and to work at a team level. There is also another notion with respect to onboard training. It really hasn't gathered full momentum yet, but there is a lot of talk about it, where you take carry-ons onboard ship to prepare for the actual mission. I'll give you a few disconnected examples.

At some point in time a few years ago, we tried to develop an orientation trainer for the Marines, who could prepare themselves prior to the actual landing by familiarizing themselves with the sort of conditions and environment that they were going to face during the actual landing. That was a very large system which ended up not having space available onboard ship. But now you're beginning to see - and you're seeing them out on the floor right now - these video disk systems, which allow you to walk through certain areas and familiarize yourself with the local terrain in relationship to some . . . Now that's one thing we think may be going onboard. You're also seeing readiness training in the form of things like SWAT - these squad trainers where Marines are able to shoot at a movie screen and keep their skills up that way. This has been talked about as being take on.

Picking up on Jim's point about trying to maintain perishable skills, the idea - very, very specialized part-task trainers that don't take up a lot of space, that hone these very ephemeral skills such as the actual carrier landing situation, is being experimented with. So over and above the team training thing, where you have the whole ship essentially in a training mode, there is this notion of carry on.

On the air side, you have something developing from the Air Force which may, in fact, transport itself into the Navy, called a combat mission trainer. The notion here is to actually provide a simulator which is portable. That's in its very early stages - I think it's at the 6/3 level at the moment - but they're talking

now about having visual systems that are essentially totally enclosed, just a visor, foreground system. Obviously, that should be considered on a carrier.

Admiral Hogan

Let me say a couple of other words on this thing. Again, I have to go back to my own experience on the Kitty Hawk. We made the number one main machinery space on that ship our school of the ship. We labeled the equipment, and unlike many things that we talked about here, configuration control is really a problem. I think that's what Jim was talking about here - the differences between each ship and each ship within a class. But when you have them on the ship, you have them with the equipment they're going to work on. And we simply made that into the classroom that we taught them in and we used video techniques to get the guy who really knew what he was saying, the 1st Class Mechanic who really knew his machinery and his equipment, and we just put that guy on tape so that when he left we didn't lose that knowledge. And it's those kinds of things that we can do in a much better way and a much more organized way and in a much more sensible way and just have a better system out there.

I disagree with Jim in the case of not being able to bring the schoolhouse to the ship, because in many instances, the guy doesn't go through the schoolhouse. We're a little better in that now than we were in the past, but we have to do a lot of individual specialized training from the ground up, including the knowledge side of it, on the ship. The guy who has done that the best in the schoolhouse side, of course, providing the people before they get there with those prerequisite skills, is Admiral Rickover. He spent a lot of money and has quite a system in place so that the people who go and run his nuclear power plant know what they're doing. And they don't turn over very often, and they're trained and they're qualified, or they're fired. We should get that same kind of discipline throughout the Navy. We do reasonably well in that in aviation, because if you have an untrained guy fixing your airplane, you die. It's that simple. So we don't want untrained guys fixing our airplanes. And we take a very hard look at that and we do more walking and talking in that case, because we put the money up front to get the training done.

It's a tough, hard problem that we've got to work together on in the sense of putting together packages that are affordable and they're not the kind of packages that we're going to have to change every two years so everybody can make a few more bucks out there. We have to put together a real solid system that is going to last and I urge you to help us do that.

We've beat this one to death. How about another question?

Question

(Cannot be understood)

Admiral Hogan

I've been asking this question of who's in charge of this thing since I've been in the business. I'm a senior in the Pentagon, and my athletic scholarship expires at the end of this year, and I want to find out the answer to that. I haven't found it yet. I could tell you who does it in the nuclear community - Admiral Rickover. I just told you. He uses zero simulation. You guys wouldn't even get in the door if he were here - well, he wouldn't come, but that's another story. He really believes in hands-on and working on equipment that you're going to actually operate and that's why he has built the prototype concepts. And it makes a lot of sense when you can afford to do that, and you have to afford to do that in the nuclear power application.

I don't really have an answer. I wish I could put it together. What I'm after, though, is exactly what you just alluded to - the three things we really do is we educate somebody so he's got the basic knowledge; then we train him so he can apply those skills; and then we practice so he gets good at it. We're trying to do that whole realm of things on those ships and we're using the schoolhouse to support us with that basic knowledge input before he gets there.

We have to coordinate this thing better. We've made some steps within the Navy with the . . . organization, which is Manpower and Training, hooking them together. Their effectiveness is not there yet, but that's probably going to be the source within the Navy of putting these kinds of concepts together because the guy who works for . . . is the CNET, the Chief of Naval Education and Training, and that's really where it should come from. I thought about this this morning. We really should have a CNET guy on the panel. Is anybody from CNET there who wants to say anything?

Panel Member

The problem is rather complex. When you look at some of the modern systems we're fielding out there, the maintenance pipeline for the sonars that are now going on the surface ships is well in excess of a year. You start talking about tying academics into pipelines like that and you're looking at a 20-year career before you really get started. The problem is a little bit more complex than just where do we want to do it. The question is now, what is the minimum amount of technical training we can give those technicians so that they can be qualified to maintain that equipment so we can get on with using it. I'm afraid at the moment the academic issue is academic.

Question

(Cannot be understood)

LCDR Lemkin

We're highly supportive of onboard training in the Submarine Force and those of you who heard my pitch on Monday, we're turning to it with increased emphasis. What we're looking at, though, is the new, upcoming, next generation of fire control, sonar, ESM systems to have an embedded, organic, onboard training capability. Of course, everybody knows that the systems we designed in the past had that capability and, of course, that's the first thing that got cut with the budget cut. But we're pushing for that. Add-ons we tried in some areas - sonar, for example, to put an add-on onboard trainer. We're still working on that, but they get expensive and we don't have that much room on a submarine. We don't have room for the tactical equipment we need to put onboard, and you know which ends up having priority. But our feeling is that we want to maximize onboard training. We have a captive audience onboard. You've got a lot of time - when a guy is sitting on watch and if the submarine is in a transit mode and he doesn't have that much to do, he could be training effectively during that period. We have a lot of shore-based trainers, very sophisticated, expensive trainers and some of them are under-utilized. I don't want to generalize on that, but it's difficult, especially for a one-crew submarine, a fast attack submarine, to get that crew off the ship and up to the shore-based trainer when they're in port. That becomes even more of a problem if the trainer is not as effective as it should be, if it has a number of faults, that makes it just not worthwhile.

We've also, as far as the gentleman who first brought the topic up, talked about who is going to monitor this onboard training. You're going to do it onboard, but who's going to checking on the ship. Well, I'm not that familiar with the air side and the surface side, but we frequently send representatives of our Type Commanders and our squadrons, at least for short periods, to monitor them. We've done that in the propulsion plant area for years. If we push this on the Type Commander and the squadron level, it's going to happen. If they don't push it at that level, then it won't happen. That's just the way things are.

To sum up, we are putting a lot of emphasis on onboard training but we have some means we use now, we utilize the capabilities we've got onboard, but we need a better capability in the next generation of systems onboard the ship, an embedded capability, and that's what we're looking for.

Admiral Hogan

We've all got the same problems. The dimensions are different - the size of the submarine crew compared to the 5,000 people on the aircraft carrier give a different dimensional content, but it's the same basic problem that we're trying to get at.

Question

(Cannot be understood)

Admiral Hogan

I have a note here to try to repeat the questions. I can't do that with this one, but I hope you all heard it.

I think there is some validity in what you say, but I don't think the idea of what we ought to be doing is try to fool the guy that you're trying to teach into learning something. So I have a philosophical difference with you. You should make it fun and he should enjoy that knowledge gain he gets, but trying to make a game out of it is not necessarily or would not be my approach. I could be wrong, but that's the way I see the thing. I think those kinds of techniques, though, that are enjoyable to do in a serious vein are positive things we can put on those ships and they're easy to install. I strongly support that and I think we can wire the ships up so that those kinds of things are available and present them in a way that the guy is going to enjoy, or at least not be turned off by them, in the truest sense. So there is a lot of application out there for that.

Panel Member

Just a brief comment on that. I think the little bit of experience we've seen with respect to the idea of competition is a very attractive feature in training. The ... . . for example, is a very attractive simulator because you have a very distinct outcome when two trainees get in either side of that thing and the element of competition drives them to line up to use the device, which is surprising. Also, in NAVTAG, which is a war gaming device that we're just putting together - a very simple table top device to teach the elements of war gaming - is again a very attractive device, very, very popular because of the competitive aspects of it. People have suggested from time to time that in some of these part-task trainers, such as the LSO part-task trainer, that if one were to give a guy a score at the end of it, that that would be a beer score to work towards. So competition, if it can be built in, may provide that enticement.

Panel Member

One thing that ought to be mentioned, when we talk about onboard training in the surface Navy, we're really talking about simulating an external environment and stimulating onboard equipment so that our trainee is not in a game room, he is at his operating station and as far as he knows, he's at war. The issue then becomes not one of interest, but one of survival. The question becomes how do we measure his performance.

Admiral Hogan

All good points. One of the things though, related I think to your basic concept, is we do reasonably well in some of our schoolhouses now with some nice equipment and so forth, and the guy comes out of there and he goes to "the real world" at sea and he walks on some of our older ships and let's say he's a propulsion plant operator and he goes down into the real world. He thinks he has graduated and gone to hell, in a literal sense, because the austere, very nice, clean environment he was in at school doesn't necessarily exist to that degree on the ship. But we can provide the ships the schoolhouse atmosphere in this regard, and show him a first class operation of the kinds of things that you're talking to in the use of modern technology, both in the operating and maintaining and the teaching of the professional skills there, he's going to think he's in a first class operation. We're going to be paying him to go to sea. We're probably going to retain a lot more guys if we put that kind of system out there, which is the bottom line of where I'm coming from - to try to make the environment at sea a better situation for our young sailors and motivate them in the ways that you talked to to be smarter, be more skillful, be more productive, and that productivity turns out in the bottom line to being combat readiness, that's what we're after.

Question

(Cannot be understood)

Dr. Henris

One of the things we're finding out about maintenance training is that in this equipment we're now dealing with, a great deal of maintenance training is diagnostics and a great deal of the diagnostics is done by the operator at his station. So, yes, in that regard we are anticipating considerable onboard maintenance to the extent of at least finding out where the problem is, isolating it, and working around it. As far as the manual part of maintenance, in the surface Navy we're only starting, but we are taking a look at some training capability that could be put aboard to again refresh maintenance training that was provided elsewhere. At the moment, we're not talking about doing pipeline type training onboard the ship, but certainly the need for refreshing the skills, if you will, is recognized and some of the new CAI type instruction and so forth could have application there.

Panel Member

There is something, again, very early on in the thought process of various hand-held devices being considered as a maintenance aid onboard ship. They are being considered even so far as being fed by satellite from some main data base. There are several programs ongoing - I don't know which one will survive, if any. Some of them are talking about using them as training aids. . . . . . this is educational history and experience history.

Loading the device with a specific data base, if he's going to maintain a certain black box. Do you follow the notion?

Admiral Hogan

We've got a program underway now called NTIPS - I think it's the Navy Technical Publications Improvement Program. What I'm trying to do in that program - and I'm coming in from the side on it and trying to do it on the VINSON - is do the kinds of things that your question is pointed at; get a system that not only provides you with the correct documentation, updated and easily accessible, but it also gives you those steps and procedures on how to do things, from specific preventive maintenance tasks on into troubleshooting and corrective maintenance. There are all sorts of opportunities to do this. We've taken the steps on the VINSON, simple things of aircraft elevator maintenance, from a knowledge level of the fundamental things, how that system operates and works and so forth. We've actually built a technical manual and then a way to go into the technical manual and then a way to procedurally follow different steps, both in the preventative and corrective maintenance areas, and we're hooking that up to those laser disks and video displays so that we can get some sort of automation and pictures out there on how the guy does things and eventually, I would expect within this decade, that the guy instead of having a maintenance manual will go out there and plug in this little briefcase kind of a thing and have an iterative process with, probably in the carrier's case, an onboard computer and that will be his supervision and his procedural checkpoints going through there. We can do a lot in that regard. Again, we're talking productivity and the individual, and better reliability and maintainability, fewer guys, all the kinds of things we need to do as we move on in this area. We're just waiting for people to come in and help us do these kinds of things. That's the business you guys are supposed to be in. To put it bluntly, I want to see more people work at this and not sit back and say, "Hey, Navy, you come and tell us what you want and then we'll build it for you and we'll do a cost plus contract and away we'll go." Let's get some innovative ideas out there, talk to people, go into the environment and get something done. That's what I'm looking for.

Question

Isn't the money in the Navy's R&D training funds?

Admiral Hogan

Why does the Navy have to put the money up, sir? Yes, there's money in there. We have money in the NTIPS. We're putting about $3 million on this VINSON program that we're trying to dig up. There's money out there. But I'm looking for you guys to come in with some ideas and give us a hand in this thing. A lot of these things are conceptual. They're not going to cost you much to come

in and talk to us about them. I hate to be an adversary in this thing, but I'm a pretty good adversary and that's what I'm talking about. Let's get this group together and work together

Dr. Harvey

Off the top of my head, I'll give you round numbers. The 62757N program, which is out program, is about $4 million or just less than that. There virtually is no 61. We're pretty much an applications oriented function. In 63, my guess is that we are in the $8 million realm and of course, once one gets to 64, you're talking about first article procurements and there's not much room for experimentation once you get to that point in time. I think the Surface Navy has about $50 million, round numbers. The Air Navy subsumes the training component, very often under its main weapon line, so the amount there is not easy to quote. The Submarine Navy has maybe $10 million, something like that.

Question

Dr. Harvey, on the 62 money, is that mostly XPEC money or . . . .

Dr. Harvey

There are about 80 people in the lab, again, round numbers. All of those people are supported reimbursably through that $4 million. There's also the $8 million of 63, which is available for their support. So if you add the two together, you come up with $11 or $12 million, out of which have to be paid salaries. The rest goes out under contract.

Panel Member

There is considerable separate money going places like NPRDC. There are other Navy labs getting some of that 62 money. I don't know how much.

Admiral Hogan

Along the same line, there is about $1.2 billion going out every year from the Chief of Naval Material for things that we can label as support services. I don't know what's coming back with that money, but there's a lot of mc ey out there that you guys might be able to tap and come back to us with with some ideas.

Question

I'm from NTEC myself, and I'd like to go back to the organic thing that you touched on briefly before, and that is the aspect of being able to critique the thing onboard after you've done the exercise. I can remember back in the days when you did an awful lot of . . . on the . . . submarine. But I also remember that as soon as we pulled the trigger, our immediate concern was firing that torpedo, and we forgot all about the critique. I think

that's a danger that we have to be very conscious of as we go into onboard training, and that is how in the world are we going to critique the thing and be sure that we got valuable training as opposed to just going into a drill. We do have an R&D project in the Submarine Navy, called SMART, which hopefully is working toward that aspect of being able to have some onboard critique, because again, we don't have the trained instructor there to do that, by and large. The C.O. may be able to do it, but he may not have the capability to do what we really need out there and this is something that needs to be looked at very carefully - what in the world are we going to do in terms of critiquing our onboard training?

Dr. Harvey

I mentioned earlier this week that if we are going to be successful in getting embedded training, we have got to get better ways of establishing performance measures and on top of that, getting a greater level of acceptance within the Fleet for the measures which are provided. We tend, time and time again, to be preoccupied with the hardware and some of these softer problems that are a part of our community, we tend to push under the rug. Performance measurement, freeze, replay, and the general instruction that is going to have to be addressed in the absence of somebody looking over your shoulder is paramount in this whole excursion.

Panel Member

Adding to that just a little bit, as far as the Surface Navy is concerned, the intent is to build on what was found out through the SMARTS effort and supplement that with onboard hardware. It is recognized that there has to be some form of instructor control; whether that can be used through one of the existing consoles or requires a separate console depends upon the configuration of the fire control system, in many cases. In addition, some of the new class surface ships are coming up with a wide screen display designed into their CIC. It appears that where that doesn't exist, we're going to have to put one there, because to do critique ultimately is going to require some ability to rerun parts of the program and show people what happened when and why things didn't go right. So there is a combined effort, starting with performance measures and then how do you automate it, along with the hardware to control the problem and critique it.

Dr. Harvey

If I may, I'd like to go back to the question of what are we doing with our R&D and why isn't there enough of it. If I can pull a couple of thoughts together here, throughout the conference we've had people get up and talk about low cost. Just now we heard somebody ask why we don't throw more R&D money in so that we can get something going. This is an area, in small devices, hand-held devices, maintenance devices, where the problem is just

far too big for us to handle from an R&D standpoint. We look at our measly $4 million in 62, which is our blue sky money, as we call it, to see what we can do there. We're only spending about 10 percent of that money in computer-related efforts. And the reason we're only spending that kind of money is because if we spent 100 percent of that money, we really couldn't affect the course of events in industry. The mass, the inertia of the R&D program collectively in industry is so big that we're not going to influence it substantially, even if we spend it all. So if we're not going to do that, why spend any?

The same kind of idea exists in these hand-held devices. Quite uncharacteristically, our business is usually "onesey-twosey" business. If you're talking about training aids that are loaded with some kind of disk and are used by most of the maintenance technicians in the Navy, you're talking about thousands. You're talking about "Speak and Spell" technology. You're talking about production engineering. And it seems to me that that kind of production carrot should be the driver for industry to invest its R&D. It's uncharacteristic of our business, but it represents a big plum, and it's not the hardware that is the driver. There are a large number of component technologies around - the microelectronics voice technology, the flat panels - all of these combine to make the hardware technology available. The big challenge, it seems to me, is that you have to find ways of establishing effective teachware, efficient mechanisms for getting the software into that device and the curriculum into that device. We haven't found it yet in our lab. We're hoping to do some experiments on the subject, but that's the real challenge.

Question

(Cannot be understood)

Dr. Harvey

I think one of the reasons that maintenance training has been left until last is that it's a very amorphous problem to try and get your arms around. It isn't _a_ problem. It's an enormous mass of vaguely related problems. With respect to trying to get a handle on it, MPRDC in San Diego, the NAVMAT lab out there in personnel research, is undertaking to look at the maintenance issue in a global sense and try to get some clarification as to what the main thrust should be. NTEC, as the trainer function, is looking to be a subset of that study. But the main driver is coming out of MPRDC to look at maintenance training.

Panel Member

Were you referring more to the front end analysis than the 62 research? In other words, when you say "define the problem," that really isn't a 62 research issue. That's what we tend to call analysis, as to what's our training problem. In the Surface Navy, we're funding it under 64.

Admiral Hogan

What you see out here on the floor and what I've seen around here is a lot of people treating the symptoms of the problem and they're band-aiding. It's not a step-back conceptually and taking a look at the total system and how do we identify the basic causes of those problems. That's where we're looking for people with some concepts to come in and help us do that in the Navy and when we're coming in with new systems onboard, like in the aviation industry from the F-18 into the VTX now, that we develop those systems from the beginning with that broad overview of how we're going to use them, how we're going to maintain them, and build a knowledge base to do that that's coherent, that makes sense, that's available. I don't think it's that hard. Maybe I'm oversimplifying the thing. But you have to step back if you're trying to teach somebody how to do things, you've got to give them the basic knowledge ingredients. Some guys and some of our youngsters that come up, we have to teach them how to read. That's where we start - first step. We teach them how to read. We have to go through that whole process of learning and validating what the guy is so we can get him up to a prerequisite entry level of knowledge so he can go on and develop the skills. And the Navy does pretty well in these areas, pretty outstanding. I think we've done exceptionally well in aviation and I think we've done equally as well under Admiral Rickover's programs in a different mode of operation. But we do that well, but we don't do it consistently well and we've got so much turmoil in the system that we have to redo it over and over and over again. That's part of our management problem.

Question

(Cannot be understood)

Panel Member

Well, I personally feel that the TDs are totally capable of maintaining the trainers that are coming down the road that we see in the future - the ones that are available now and the ones that we see coming down the road. Those gents are given the right kind of training and they are totally capable of maintaining those devices, given the logistics support in the initial factory training, if you will, to get them started. As long as we have TDs, my position would be that that is the work force that we must stay with. I also recognize that contractor maintenance could probably provide us more availability on the trainers, but I don't know that we need more availability, other than what is being provided now. The Navy is, of course, looking at various options, whether to stay with the military/civil service work force or whether to go to contractor maintenance across the board, and that item is under discussion and review right now. I'll have to defer to Admiral Hogan before I get myself into a position where I'm citing Navy policy without knowing what that Navy policy is going to be.

Captain Desko

The decision about the future of the TD rating, I feel is a moot point at this level, in a sense, because it is not an issue of whether or not the TDs can do the job of maintenance. It is an issue that is going to be decided upon other uses of that manpower, those assets. But I believe the optimum maintenance structure for the aviation training devices is a mix of organic capability of both civilian and military and contractor maintenance, contractor maintenance being concentrated in emerging systems that are most complex, and it may be the best way to solve that is by extending interim maintenance, the prime contractor going for more than one year on his major system.

Admiral Hogan

The only thing I'd add on that is that obviously we've got a lot of problems out there now and the problems basically come from the initial reliability and maintainability of a lot of the equipment we've got in places. We're trying to make improvements there. We're not really going to be able to turn the clock back and start over in the design and development of those systems, but we're looking for better logistic support and a better way to actually do the maintenance that is probably greater than it should be because the equipments are not as reliable and it is not as maintainable as it should be. That's my first point.

Secondly, in the Navy we've got the problems with having a prerequisite numbers of skilled and talented young men to put to sea. That's what the Navy's about - going to sea. That particular problem we have with the TD rating, where it's a shore-based rating that we've tried to put to sea and have had limited success in that regard, so really the best way to do that is to dedicate that to the shore establishment. And that becomes unproductive from manning your Fleet. So are there better ways to do that? That's what we're examining. I think, as Dan pointed out, maybe there is some mix of things that we can do in the interim. We're looking very hard at how to phase a plan that would see the disappearance of the TD rate, and a move over into either a civilianization, which we have limited amounts of within the Federal service, or the contracting out initiatives that are so prevalent in Washington today. Again, there's a lot of room for good ideas in these regards that can come from you people out there in helping us look at this management problem. It's not an easy one; it's one we've been fumbling around with and it's not getting necessarily better. My own preference is some sort of a phasing program over time. How long that time span is, it could be 5 years or 10 years, as we move on with the older devices, and I think in the newer area we have to look very hard programmatically at bringing them in with the full-up contractor support is one of the options that we're going to examine.

Panel Member

From the Surface side, there are some issues that are going to have to be answered at the Congressional and DOD levels as far as contracting support, but one way or another they're going to be answered. In the long run, we're building a whole new Surface training community and converting from basically World War II technology to building block digital technology and there is going to have to be contractor support involved in that, because there aren't people in the Navy now in the quantity trained to do that kind of thing. So we're assuming that to some degree there is going to be contractor support designed into our major acquisition, and keep in mind that an awful lot of what we're talking about there is software. The hardware is a great deal of operational equipment for our sophisticated trainers and building block hardware with very sophisticated software interfaces.

Question

(Cannot be understood)

Panel Member

We are aware of the application on the HUGHES in what you're referring to. Very frankly, there are several problems involved. The problem we're facing in the Surface Navy is a large number of ships with the requirement for acoustic refresher training. The equipment you're talking about is very expensive, is a very sophisticated signal generator. Long term, signal generators do not a trainer make. We fully recognize that it beats anything we've got in the way of a trainer because we don't have one. But in truth, it's a signal generator and we can't afford that quantity of sophisticated equipment for all the ships out there. As someone else pointed out earlier, there's no sense of solving 10 percent of the problem. So let me say at this point, all our options are open. No decision has been made and certainly the equipment you're talking about is well recognized for what it can do and that's a great deal. But it's also facing a much broader problem.

Question

(Cannot be understood)

Panel Member

Let me talk a little bit from the Air side. We have the same problem with acoustic analysis training for all of our air crew people in helicopters and P-3s and S-3s, and NPRDC has been working for about 8 or 10 years on a digital acoustic analysis simulator, trainer, or whatever. We could afford to buy one of those for every carrier. The size of the thing is so immense that it would take 4 or 5 semi-trailers in hangar bay 3 just to put it onboard. Again, that's for a specific training task, amongst which there are thousands on the carrier that you have

to deal with, so we really can't afford that kind of thing. The concept is fine. The practical application of it today within the technology makes it unsalable.

Admiral Hogan

What you're talking about is a part-task trainer to do a specific task in this case. Let me try and get this in there. That's one of the functions that the guy has to do, among many on a ship, the individuals that you're training. He's got a lot of other things to do out there. We're trying to get a coherent hold in this business - the VTX is a point where we've talked. It's a VTX-TS - total systems. And in that we've got some training management system of how we're actually going to use that to train people. This is the approach I think we've got to come down to in the total systems application of using a mix of part-task trainers and weapon systems trainers and tactics trainers and knowledge areas, and come in with a coherent whole program that is going to do this. We've been talking at various levels on the total Navy - the aircraft carrier, the submarine, the frigate, the particular weapon system in an airplane, the particular weapon systems within a ship - and that's what we're trying to get a handle on is that total systems approach and figure out how to do it better.

Panel Member

At the risk of belaboring it here, I'd be more than glad to talk more about it later.

Question

(Cannot be understood)

Dr. Harvey

That's true. I have trouble trying to verbalize this, but let me see if I can give it a shot. I'll try to repeat the question, but it was an amorphous question. The comment was made that in the area of maintenance aiding, these devices that are likely to be used for maintenance aiding, the fact that it is an amorphous problem, to use my words, and the fact that R&D by industry is expected to be offered up in the solution of that. I think the question was where do we start.

What we're trying to do at NTEC is to identify a select number of training problems onboard ship and the problem is trying to define the size of that problem. It may be to maintain a black box that's three feet high or one foot high, or it may end up just being one PC board. We don't know the dimensions of the problem. But identify a select number of different tasks.

. . . . education of the sailor in his own space on something that is quite unrelated to maintenance - remedial reading, for example. Take those select areas for tests, scope out the size of

software and the curricula that has to be embedded within a device, and then having got all of that, reduce those curricula boundaries to engineering terms and wrap some microelectronics around it with the condition that it be portable, robust, sailor-proof, and so on. And then set up a formal T&E onboard that ship and see how things work out. That's the dimension of the experiment that we hope to run. What will we get out of that? Well, we'll get out some experience. We'll also begin to establish, I hope, some generic form for the hardware and once a generic form starts to emerge, I think a fair amount of the risk associated with industry's contribution starts to go away in terms of the hardware. You could then begin to think in terms of pre-production runs of the thing and we can all focus our attention on the age old problem, which is 80 percent of the cost, of how do you get all of those various training tasks reduced to the discipline form of a software package. But we have to have the host hardware first of all and defining that is tough.

NTIP was mentioned as one effort. There is another effort called PEAM - programmable something aiding machine. That's an effort which is currently under contract to Texas Instruments in conjunction with a small company called Zyzacs, which is in the maintenance training business. There is also another program which is being driven out of NAVSEA which is called STARS - I believe it is a NATO joint-run thing. So there are a number of efforts outside NTEC which should be followed, if you're interested.

Admiral Hogan

Along that NTIPS, in the broad overview, again I recommend if you can get the kind of detail information you want, is the things we're doing on the VINSON and more particularly what Carnegie-Mellon is doing in support of that. If you want to get a conceptualized idea, what we're really trying to get in the broadest sense from some of these new applications of the technology we have, that's a good place to start. I don't know if you're going to be able to get any information from them, but if you're really interested, try.

I have time for one more question, and then we'll have to wrap this up and let the Air Force crowd in. No questions? Thanks a lot for your attention. I hope I didn't make you too mad, but I do a lot of walking around the Pentagon and not much talking. I enjoyed my stay here. Have fun. Beat Army.

AIR FORCE PANEL DISCUSSION

Brigadier General R. Violett

. . . in the Air Force from the TAF, the Tactical Air Force's position, is the best simulator of the real world training requirement that we can get. And TAF, through initiatives in the last several years, have created some flag programs to try to replicate that threat environment the best that they can in what is called "Red Flag" out in Nevada in the bombing and gunnery range complex. Through use of aggressor squadrons and aggressor forces, we've tried to replicate that Soviet bloc threat, if you will, so that we can take our squadrons a unit at a time, or at least personnel out of those units, individually, and put them across that range so that they can experience something close to a combat environment. That environment, of course, we feel is much better than flying in a simulator because you can get total involvement - command and control, and the flying, and the teamwork that goes with that particular flight discipline.

With that as a backdrop, we're able to put each one of our air crew members across that Red Flag range once every 17 months currently. Obviously, that's not frequent enough. Units go more often. The air crew goes for two weeks. His squadron may be there for six weeks. There are seven of those exercises a year. So not much opportunity for the air crew to go more frequently and get more proficient.

We have also increased the realism there by changing one of those Red Flag exercises into a command and control jamming exercise which we refer to as "Green Flag." Heretofore in the past, when we got into a jamming environment we shut the jammers off because it was too dangerous and we weren't learning enough in the cockpit. We turn the jammers on now during that particular exercise and leave them on, and if the air crew member is unable to work his radio channel, he aborts the mission, he diverts to his alternate, he can't get to the tanker, he can't talk to the airborne command and control, he can't talk to the ground controller. He is forced to abort back to the base. As you might imagine, if you're pre-planned in that environment, you can succeed in the mission. If you require spontaneous types of communications, you probably abort back to the home base. . . . is helping us in that area. But simulation of that kind of activity in a ground type simulator or ground environment is very difficult to replicate and put all of the players into a realistic scenario so that you get the right learning outcomes.

With that as a backdrop, we can get into the simulation world and I would suggest to you that we have several priorities. The first priority is that of attaining readiness; the second one, maintaining it; and the third, enhancing it. So how do you attain

it? First of all, you have to start with the basics. Basic aircraft procedures. Then emergency procedures. Then instrument procedures. Those particular problems are quite well in hand. We don't have to ask for much more help there. We've got most of the systems there - you've done it. When we get into the night/weather beyond visual range and electronic warfare training requirements, we're into another environment. We have a lot of work to do there. We don't know exactly where we are or exactly where we need to go. But we need our INTEL community helping us with that particular problem so we can design the type training programs that are necessary.

The last priority, but not necessarily the least, would be the air-to-air combat simulators, the air-to-surface simulator, and perhaps the total mission simulator. In the latter case, of course it's probably cost prohibitive to put that into each squadron or each wing or each location throughout the Tactical Air Forces. So we have our jobs cut out for us.

With that as an opening type of remark, if anyone has any questions at this time, I will be glad to entertain them before we start into the panel presentation. If not, our first presenter will be Ron Daskevich. Ron is a Major at Headquarters TAC in our Simulator Branch. He has F-4 and F-15 experience. He is responsible for setting up policies of what we need to train and how we need to go about doing that, tracking the engineering change proposals that go along with that particular requirements as we update our aircraft against the threat environment so that our simulators match that aircraft configuration to the best that we can. We're doing a lousy job at the moment of keeping that in line with the need. We're always late to need, as has been voiced by everyone so far at this conference.

Major Ronald Daskevich

Good morning, ladies and gentlemen. Eighteen months ago I went to TAC Headquarters and before that time, I don't even know if I knew how to spell simulator. All of a sudden, here I am at TAC Headquarters charged with monitoring simulator programs. But I came in at what was to a lot of people a very exciting time at TAC Headquarters. We were working a project called the Tactical Combat Trainer, or project 2360. This was going to solve all our problems for visual simulation. It was going to give us real time combat simulation. We were going to have big dual-dome visual simulators in every one of our F-15, F-16, and A-10 wings, and it was going to be the perfect training situation. Anything a person had to do in battle he could go in and do on these simulators. Whether or not that was true, I don't know. But the initial cost to do strictly the research and development for this type of program started out at around $35 million. But then there were other priorities, and the program had to slip a little bit. Well, after a few of these slips, the price for the research and development for this project got up to around $85 million. So that caused some people to have a few second thoughts. When you looked at the

overall picture, what it was going to take us to build these domes at the bases, to buy the additional trainers that we put into the domes and integrate, the total price tag exceeded $750 million. We're getting close to a billion dollars, now. At the same time in our Forces today, we're making a conscious effort to increase the number of fighting machines we have and you have a definite conflict between how much rubber you have on the ramp, when the horn goes off tomorrow how many airplanes are we going to be able to put into battle and how we're going to train those people, there are some very hard decisions to be made. And a billion dollars buys an awful lot of airplanes.

Needless to say, about a month after I got to TAC Headquarters, all of a sudden we have no 2360 anymore. That's gone. There had been a tremendous amount of work put into defining what our training requirements were, what our needs for visual simulation were. We had foregone some other approaches, some part-task trainers for air-to-air, although we have one that will be covered later in this panel. All that was gone. And the question was, okay, TAC, what are your requirements for visual training devices? Here we go - there was another panel yesterday that said what would a hypothetical major do if he had a training task and needed to define that task and define the realism that needed to be simulated to give the proper training. Well, here again, we have that problem. So we decided the engineers had had their shot at it, all the people at Headquarters had had their shot at it, let's give the people out in the field, the people who are actually doing the training and the people who are using the equipment, let's give them a shot at it.

So last November, we developed a task listing questionnaire. It was taken quite a bit from the work that had already been done in listing the tasks and defining the requirements as to what needed to be done. We sent these questionnaires out to every unit in the Tactical Air Forces - in the Pacific, in Europe, Alaska, as well as the States. And we asked people a few questions. We said, Of these tasks, which one of these tasks do you think we can train better. If they don't think they can train them better, then maybe we don't need to worry that much about it right now. But if you can train it better, how can we best do that? And then we gave them a few options. Do you want a better training device? A better simulator? Do you want a part-task trainer? And we felt that we had to throw in the option of more flying time. We knew that the majority of the remarks would come back with more flying time, but we also felt that given that option, the operators, the people out there in the field, could choose flying time as well as have the option for a part-task trainer or simulator, then those tasks that fell out of that questionnaire, that even though the option was given for more flying time, if the people said yes, we need better simulation, better part-task trainers, we thought maybe then we would have a good starting place as to what to look for. Not surprising, we had several categories fall out of that questionnaire and as General Violett mentioned, there are several stages

in that training. There are some things that you need to learn before you get into the airplane, basic procedures. You can't waste time flying an airplane to learn the basic procedures. You've got to be able to get in that airplane and do the tasks that are necessary. And then from there, you reach a plateau where there are some things now that you can do better in an airplane than you can do in a simulator. And then you have a few stages like that. A person has to know the basic procedures before he can get in the airplane to fly, and then he has to get out of the airplane again to learn most of the emergency procedures. When a person goes to war, there are certain things that he's going to do there that there is no way he can ever train for. How can you train a person to dodge a missile coming at him without shooting him down in the air, unless you have some sort of training device?

So what came out of our survey were three categories. Number one, the things that we felt you needed a very sophisticated, wide field of view, visual type simulation which would give you a realistic in combat environment to train. These were the things like the SAMs coming up at the aircraft. Things like an air-to-air missile coming at you. How do you react to a head-on shot in an air-to-air missile. Something we have no way of doing in our training today unless we go to war and try to shoot someone down.

Next, there were several tasks which we thought could be done with limited field of view type systems. Air refueling might be one of those. Instruments might be one of those, and as General Violett mentioned, there's a difference between your basic instrument procedures and how you train a person to break out of the weather. Some of these things are very similar to what the commercial airliners face, but we have to carry it quite a few steps beyond that. You might say that our requirements for visual simulation pick up where theirs leave off.

Then there were certain other things that came to our attention that really weren't surprises, but there were many other things that we needed to look at. New weapon systems that we're getting that you might classify as visual simulation requirements, such as your infra-red, your other data bases for radar. All these have to be integrated. You can't have a piece-meal approach without having some way to put everything together. I think the best way to put most of the things together is to actually go out and fly the airplane. It takes 1,000 hours of flying time to have a 1,000-hour experienced fighter pilot. A thousand hours in a simulator is not going to substitute. But I offer you this, if you have a 1,000-hour fighter pilot with good training in training devices which he can put together a lot of the piecemeal things with good training devices, he's going to be a better pilot than the 1,000-hour fighter pilot who has done nothing but sit in the airplane and punch holes in the sky.

I think probably that's enough of our history. Our basic requirements that will be covered in a little more detail from other

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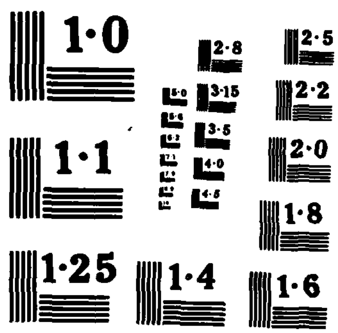
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members of the panel, are basically what you see up there. We have an air-to-air combat training requirement, both at high altitude and low altitude; air-to-ground; close air support interdiction. These are things that we feel would probably require a wide angle field of view, a very much more sophisticated system than we have today to integrate everything, depending on the level you want to train a person.

Low level navigation is a real problem and when you throw in the aspect of using infra-red to navigate at low altitudes, I don't think I'm ready to go jump in an F-16 and go down at 200 feet under the weather at night, even though I'm the greatest fighter pilot in the world, unless I have some background, some training that gives me a little bit of confidence that the systems work, that I've been able to do it in an environment that I know when I hit the ground it's not going to kill me the first time. If I can get a little bit of that under my belt, I'll be a much better pilot when I get in the airplane.

Landing/take-off - the commercial airliners do a pretty good job of that. Their systems do a pretty good job of that. In our job, if we get the flying time we need to get that 1,000-hour fighter pilot that experience, then he's got to take off and land. But what we need the capability to do is to introduce some of the complications.

Formation flight - we do a lot of that and we don't really need a training device to teach us how to fly formation. But if we have the devices which will give us the capabilities which are necessary for air-to-air combat and air-to-ground combat simulation, that would probably be a fall-out capability.

Aerial refueling - again, that goes in with formation. If we have the capability to simulate the other things, I think that capability will also be a side benefit.

So, that's really a general shotgun approach, and I'll turn the program over to our next panelist.

General Violett

Our next speaker is Mr. Jack Wilson. Jack is an Air National Guard pilot, flies A-7s currently. He is responsible as a program engineer for the F-111A. He's in Aeronautical Systems Division at Wright-Patterson, Deputy for Simulators, and works in the Engineering Directorate.

Mr. Jack Wilson

Thank you, sir. I'll be speaking with two hats on: one as a user, as a fighter pilot, the other as an engineer, being a full-time engineer and a part-time fighter pilot.

What I'd like to talk about is how do we get there from here. How do we get from the tasks that we need to train a fighter pilot, how do we get from knowing what those tasks are to having simulation equipment you can use to help improve the efficiency of a fighter pilot.

Looking at the major tasks, the task list that was up here before, I'll be talking primarily of air-to-air and air-to-surface tasks. For the air-to-air tasks, talking the initial training, basic fighter maneuvering, tactical formation, and also air combat tactics, both offensively and defensively, and the ability to acquire encounter threats, be they air-to-air threats, surface-to-air missiles, anti-aircraft fire.

For air-to-surface tasks, they include the low altitude tactical navigation, tactical formation, and weapons employment - weapons employment beginning with initial type training for qualification on a scorable range through continuation training where we develop tactics and work on our tactics in both low threat environments where there are lower level defenses, to high threat environments where there are severe defenses. And again, as an air-to-surface pilot, you still have to be aware of the air-to-air threat - he's going to be after me just as well as he'll be after air-to-air aircraft, and you have to be able to counter such threats.

When looking at air-to-air and air-to-surface training, either in the airplane or in a high quality, very capable simulator, the intent is the same. The training intent. We're trying to orient the fighter pilot so that he can understand the environment, what's in the environment, so that he's aware of the situation, can maneuver relative to other aircraft and relative to a surface target, if he's an air-to-surface strike airplane.

Trying to teach somebody handling qualities when he is flying the aircraft at maximum performance. We're looking at visual search, visual acquisition for either an air-to-air target, an aggressor aircraft, surface-to-air missile, or surface target. We're looking at learning how to manage your weapon system so that it is most effective; how to employ your weapon system to deliver the ordnance; and last, but by no means least, teamwork - working together with other aircraft to survive and to most effectively perform your mission.

This training is performed at three basic levels. One is initial training, initial qualification when someone is learning how to fly the airplane. Secondly, there is continuation training to refresh your skills, to maintain your skills. That's done at an operational unit level. Thirdly, the combat-type training, as done at Red Flag, Maple Flag, Green Flag, where there are opportunities for extensive low altitude flight against aggressor aircraft, where there is low altitude air-to-air, or where there are multi-fighter engagements.

Looking at the training that is necessary and the levels of training, the bulk of the training is in the operational unit, continuation training and combat training. We need to look at how we come up with the requirements for a visual system. To develop these requirements it takes cooperation of the user, because he is the one in the end that has to use the device. The user has to clearly voice and strongly support the requirement. He has to accurately define and as completely as possible define the tasks, how to perform the tasks, what cues do I see and use. Then the engineer has to translate these into technical requirements. He has to analyze current technology, see what technology can support, translate the training requirements to technical requirements, and involve the user throughout the process, because he is the check that will help come up with a more effective system.

We need to define areas for research and development. What can't we support with current technology? As we assess the requirements for air-to-air and air-to-surface training, we find there are a lot of parallels. Many parallels in the requirements for a visual system. The field of view, for an air-to-air pilot, who may have somebody at 6 o'clock, who may have a missile coming up behind him, that requires the same field of view as it does for somebody on an interdiction mission, trying to strike a target, who is fired at by a SAM or who is attacked at low altitude by an interceptor.

When you look at the resolution requirements for an air-to-air system and you look at a MIG-23 size target, about 48 feet long and about a 26-foot wing span, at 12,000 to 18,000 feet and you look at a T-72 tank at 10,000 to 12,000 feet where you will begin the maneuver to deliver ordnance on the target. The T-72 is about 28 feet by about 6 feet high. You require very similar resolution in an air-to-air or an air-to-surface target. The scene content for both roles is very similar. You're looking for other aircraft on the scene, be he your wingman or be he somebody that you're trying to shoot at. You're looking for surface cues for visual navigation, for orientation, for altitude and velocity cues. You're looking for surface-to-air threats or surface targets or air-to-air threats - maybe missiles, maybe other airplanes, or maybe targets.

When you look at what's required to provide you with this information, for either an air-to-air or an air-to-surface system, what tactics development, tactics employment, there are two major components. One is the image generator that provides you with the complexity of the scene, provides you with the three dimensional objects, provides you with texturing information that allows you to fly at low altitudes. It also provides the area of the environment. You look at the visual display which permits you to have the field of view necessary, the resolution, the contrast, brightness and other characteristics of a visual system. You, as

contractors, have the incentive commercially to develop image generators, because there are direct commercial applications. When it comes to visual displays, the incentive has to be provided by one of the Services within the Government because there aren't commercial applications for an air-to-air or an air-to-surface tactical/visual system.

The area that is the key to tactical fighter simulators is the visual display. Need to provide the field of view, the resolution, displayed scene content. Displayed scene content normally drives us to an area of interest approach where we provide, like Dennis Breglia talked about yesterday for his laser projector, an area of high resolution and higher detail so that you can pick out the targets - the other aircraft, the missiles that are more difficult to see - and a lower resolution area around it that provides you with supporting peripheral information so that you can feel comfortable at low altitude, so that you don't have a stark area of interest out in front of you that may be distracting.

When we look at what systems are available today, what systems exist, there are two types. One is the optical mosaic, as in the simulator for air-to-air combat that Colonel Joe Robinson will be talking about a little later on this panel. It's a one-of-a-kind device that has been very effectively used for training. The Navy has devices 2E6 and 2F112. Dome type devices. Again, effectively used for air-to-air training. We in the Air Force, for air-to-surface training, have used a research device, the Advanced Simulator for Pilot Training, which has been used for initial training of A-10 and F-16 pilots to get them oriented to the airplane and to the air-to-surface world.

Each of these systems does have some limitations, but they provide effective training. Where do we go from here? We have some critical display technology developments that are in the works now. Most are small developments, but can provide a large pay-off for later. There is Project EDIT, which is . . . display integration and test. It is to take TCT - Tactical Combat Trainer - residual assets to develop the technology to the point where we can first do an engineering evaluation on the system, then do a subjective evaluation - an off-cockpit subjective evaluation, and thirdly, to do an evaluation on the cockpit. This effort is a cooperative effort between the Deputy for Simulators and the Naval Training Equipment Center here in Orlando.

Another program is Project MRIT - . . . Inset and Test. This is to look at optical mosaic systems, to evaluate them, to provide a subjective evaluation of the technology.

Thirdly, head couple visual displays, being developed by the Air Force AeroMedical Research Laboratories. These are helmet mounted. There are some limitations in the field of view. It is a long-term program. There have been some problems

in coming up with them and completing the system to allow demonstration of the device.

Another program is Project 2363, which is being done by the Air Force Human Resources Lab, Operational Training Division. Part of this program is display development.

These are the current critical display technology developments that are being performed. Where do we go from here?

The first thing we need to do is complete the evaluation of the TCT technology. Secondly is to develop a full-scale tactical/visual system to allow evaluation, a training evaluation of the system to see how effective it is. Then we need, based on that training evaluation, to determine whether or not to put it into production, how many do we need, where do we want to put them.

Then I come down to the question that I used as the title of my presentation, how do we get there from here? First thing we need is clear, strongly voiced user support, user requirement. Secondly, we need adequate and stable funding. The biggest problem on the TCT program was a lack of adequate and stable funding. My personal opinion is that we, with the contractor, probably used at least six months of our effort trying to restructure programs. Trying to figure out how to use the money that remained. And lastly, and very important for any visual system development is continuous user involvement throughout the entire program.

Thank you.

General Violett

Major George Buckland has a Ph.D. in Psychology, and until recently was at the Human Resources Laboratory at Williams. He will give us a short overview on Project 2363 and we'll try to stick to our 8 minutes.

Major George Buckland

My charter was to address research issues, and as you are aware, there are a great many research issues, so I'm focusing on 2363, which I believe will provide the best vehicle in the future for ultimately deciding many of these training effectiveness issues.

Some of the slides are a little dim here, and that is also a problem in the current simulation itself. You see the ASPT is on top and then there's a photo taken inside the simulator. Some of this work has been presented by other researchers. There are several ongoing studies now to get at least preliminary answers to how much is enough visual simulation.

This slide just illustrates some of the capabilities of the Project 2363, the AVTS Computer Image Generated System Design.

It will have color, it will have ten channels, it's expandable in that area. It will actually have 8,000 edges, but 2,000 will be dedicated to circular features. It can generate one circle for every two edges, which should greatly add to scene detail and complexity.

Jumping down, it will have a greater number of coordinate sets. They are nearly at the 128 point now of moving models - 8 expandable to 15. It should be much more than enough for most air-to-air environments and most reasonable air-to-ground training requirements. Of course you have articulated parts for things like refueling and segments of aircraft that would move separately. It will have a data base modeling system, texturing of course I've worked in myself. I feel that's very important. With texturing, if you've seen any of the advanced CIG concepts, you see that it adds a great deal of richness to the scene without using up all of your edges. And then it will also have 4,000 point features for light points and such items as that.

Project 2363 also includes an advanced light valve design. This is a prototype light valve. It has several goals - increasing the brightness, luminous output, reducing lag, smearing, doing away with flicker. The capability for many rasters for your high resolution air-to-air and air-to-ground targets, which we feel is essential. It's probably the best long-range solution for high detail. It also has an ability to compensate for optical distortions for dome projection systems that might choose to use this.

Right now the light valve portion of the project is a little short of funding this year. We hope to get it going stronger next year. There are eight major tasks that have been defined and four of them are funded at the current time. Each of the tasks have sub-tasks to come up with the ultimate light valve.

This slide just shows a comparison between the CIG/Projection devices, an ASPT and a 2363 in a few areas. The ultimate background resolution should be better and, of course, with the miniraster inserts we're looking towards 1 . . . resolution there. A larger number of moving targets, color. Brightness is shown as the same, but that's where ASPT started, not necessarily where it is currently, and with the light valves there is a potential for greater brightness with a more advanced light valve.

And then the update rate that I haven't mentioned before - many people feel that for fighter applications, especially near the ground, you may need 60 Hz capability. We'll have 60 Hz capability, too. That will require reducing the overall number of edges in the scene, but the research capability will be there.

That's all I've got on 2363 per se. I do have some slides which depict many of the question areas, and HRL is doing work in those areas at the current time. There are people here in this audience who are working on that. I've worked on it myself in the

past. Many of you, I think, are already familiar with those and I'll just skip over those for now and if there are questions, we might get back to them.

Thank you very much.

General Violett

I'd like now to introduce Lieutenant Colon el Joe Robinson, who is a Commander of our air-to-air simulator out at Luke Air Force Base in Arizona. He's a fighter pilot with over 5,000 hours of fighter flying. He has over 2,000 hours of instructor time in fighters, and if there's anyone on this panel who understands the relationship of how to teach someone the air-to-air requirements, it's Joe.

Lieutenant Colonel Joe Robinson

Good morning, ladies and gentlemen.

In the discussions of the last two days, the simulator for air-to-air combat has come up in no less than five panels, including a discussion on motion yesterday. So I drug out some slides last night and what I propose to do this morning is to show you what we have out at Luke, tell you very briefly what we're doing with it, and point out a couple of studies that we've done to measure the effectiveness of what we're doing, and then under the category I would call "lessons learned," just throw out a smorgasbord of ideas that are intended to invite discussion, if not outright argument.

First of all, this is what the simulator for air-to-air combat looks like. It sits on a 6° freedom of motion base system. It has a visual system that is provided by CRTs, which you can see surround the cockpit. This is unique to this and the SPT over at Williams Air Force Base, compared to the dome systems that most other people use. The aircraft itself, where the background scene, let's say, is projected with a synthetic terrain generator, it's analog, it's repeating, it's a block matrix and I'll show you a picture of that. The airplane is generated back in the box in the back corner. It's an analog system. It has its own separate raster and it's superimposed on the background scene. Of course, the console operation station is out front. This is what it looks like up close. You can see the eight CRTs that completely surround the cockpit. The cockpit that we currently have in there is the F-4 cockpit. We have plans to put F-15 cockpits in that in the future.

With the lights overhead, this shows up fairly dim, but you can see this is what the airplane looks like. We have complete F-4 . . . in there - that is an F-4 . . . The background scene is a block matrix. We have a good horizon and a good height above ground, which is also unique to this particular system. I particularly like this picture because here you can see, even

with the dim light, that the blocks provide the height above terrain. The targets are very clear. I particularly like this picture because the radar scope and all the lights and so forth are in there. We have all the lights and switchology to tune, fire, and monitor the weapons, plus the visual scene to maneuver in.

The console display - I'll only say that that's relatively simple. I'll mention that later on. We keep it simple because we have TDY pilots who come in and operate the station. It's designed very much like the cockpit in the airplane so it takes a minimum amount of training to get the instructors to use this.

Here's one of the displays on the console. You may recognize that we stole this one from the ACMR people. There are a few of our own improvements on this. A lot of data on the bobbin down here, we record this on the visual recorders complete with the instructor's comments that are played back to the students at the end of a mission.

Some of the unique features - these came up in other panels as well; the stop action, record playback, video tape briefing that I just mentioned. We have a data collection capability out there that we use for transfer of training subjects, etc., and we can add new threats because the machine is reprogrammable. Right now, we have F-4 cockpits in there. We can fly F-4D, F-4E, MIG-21 is in there, we have complete missile simulation, we have a 2-V1, a 2 versus 1 capability, we can fly the adversary as a computer target or as a hand-flown target from the console, as well.

How are we using this system? Well, we run a three-fold program. One, and primary, we run the formal training force for TAC and we have students from all over the world and instructors from all over the world to participate in that. We do other continuation training, as well. In the research field, we do training research but we also do some hardware research. We ran a gun sight test for the Avionics Lab only this spring. And in the tactics area, we work with the aggressors and Nellis people in the tactics development using the threat.

This is what the syllabus looks like - I throw it up there strictly to say that it starts from learning your airplane and your weapon system and goes all the way through interacting with the threat. That is about 10.4 hours of flying time. The guy gets about 400 events in the week that he's with us. He shoots about $15 million worth of missiles and he's Ace 20 times.

But what's the value of the training? Well, we went through the whole spectrum from the OT report to asking the users that have looked at over 1200 students now to include a couple of concrete studies here in the last year. The first study, we have the data, we have the results. It's not published yet. The

second one is published. It's on the street and you can obtain those. I will only say that I can discuss those - I won't try to do it today in deference to time. But the two studies, one is to look at the training progression for one week of training, intensive training. The other is to see what portion of that transfer to the cockpit. So one is an in-house, the other is a control group that goes on and is measured on the . . . range and the results of those, the first one runs from about 25 percent improvement to 294 percent improvement. The second one - does it transfer to the airplane? Yes it does and it's a measurable amount.

Now for the fun part. The smorgasbord. Three years ago I was not necessarily a believer in visual, but let me just say very quickly some thoughts for discussion. I'm a believer in the visual. I think that after three years of experience, the visual bridges the gap from procedural to situation, applied situation. Teaching air-to-air I think that you need two cockpits to teach air-to-air. I think air-to-air is the most complicated or complex task because it requires judgement, anticipation, decision, and you have to have that and you have to interact to do it. You've got to have two cockpits to do that, because you have to interact with another decision-maker, not just the ground. I think the ground scene that we have in there is extremely important because height above the ground in situational awareness and aircraft performance is very important because the F-4 is not the same airplane at 15,000 feet as it is at 5,000 feet. The tactics are different, the performance and so forth is completely different. I think if we're ever going to handle our own requirements and what we need in the visual scene, we need to separate basic training from tactics. That's already been mentioned here and I won't go into detail on that. But it doesn't make any sense to me to be able to recognize a specific tank pulling out behind a specific tree if you can't kill that tank. So you need to train the ability to kill and then worry about the identification task. And that's true in air-to-air - what good is 20-mile identification if you can't kill him when you see him?

And finally, I think the time for simulators has come. I just came back from Korea. I flew the old obsolete F-4D. Congress has been very good to us to provide very complex weapons to hang on our airplanes. They've been so good that in my own estimation, it takes about 50 hours a month to 60 hours a month to really train to the high proficiency that you need to employ those weapon systems. Now, we can't do that. We don't have the fuel to fly the airplanes; if we did, we'd wear out the airplanes before the war began; if we did that, all of our pilots would be in the hospital nursing their backsides, because they couldn't fly that over an extended period of time. So we need a high intensity training device to span that gap to provide the training to utilize those weapons to their peak proficiency.

Thank you.

General Violett

To finish up we have Lieutenant Colonel Terry Murphy, who is at our Tactical Air Warfare Center and has, as other things to do, to conduct field studies, perform operations analysis, and perhaps most importantly, conduct the cost effectiveness aspect of our training programs. He's going to wrap this panel up for you at this time.

Lieutenant Colonel Terry Murphy

I have a simplistic, direct, short little spiel here dealing with a very complex problem. I'd like to take you back to what Ron Daskevich dealt with earlier and that was the identification of our training requirements. Our job at the Warfare Center and mine in particular, is to come up with some hardware solutions to these requirements and today I'd like to zero in on the data base requirements for in-cockpit sensor displays.

An example of these would be GB-15, PAVETAC, and in anticipation of synthetic aperture radar, below the weather infra-red systems, such as LANTERN, things of this nature where we try to provide hardware for end result to the training requirement.

Investigation and going around in my travels - I should say wanderings - to the various industries and dealing with our sister Services, trying to find out how we can best deal with these training problems, I found that there was a common thread of training needs in electro-optical and in IR and eventually, I assume, synthetic aperture radar. As such, I'd like to hone in on the idea and leave this idea with you that I think we could accommodate all three of these particular systems with one type of data base, and using electro-optical as a departure point, either enhance it or degrade it, your choice.

As we've gone through with industry and the other Services in trying to find hardware solutions to our training requirements, we found that the Navy, for instance - and let me use infra-red as an example - recently put a fleer system on their A-7E, one that a lot of us in the Air Force were not aware of, primarily because we didn't really have a bona fide IR training requirement. Along came PAVETAC and then we did. Then we heard about something the Army was doing with their attack helicopters at Fort Rucker. Again, news to us. My point here is that we determine that we need something to train our air crews with, very expensive training devices for very expensive systems and costly bullets. I'll break in here and explain that the Army's identification of $2,000 rounds - we'd like to point out the GB-15 is a very expensive bullet. That's about $180,000. So therefore, I'd like to just use that as an example to lend importance and credence to what I'm saying. Our big problem in dealing with these systems is that we don't have a centralized methodology within the Department of Defense to consolidate our training requirements in such a way that we can translate and make them available to industry

to help us fulfill our training requirements and training needs. An example of this would be a singular and in effect redundant methodology for accommodating research and development for an infra-red system. The Navy has done their R&D. We do ours and the Army does theirs. And then our ASD people have to cost these things. Well, you can see the redundancy there if each Service does its own R&D. Somebody is making a lot of money and somebody is spending too much money. I'd like to promulgate the idea that we in the Department of Defense could assist industry and vice versa by centralizing our data base management in something like DMA. I believe ASD pointed out yesterday that DMA is a source of a lot of our cartography and photography that we use for data base. I contend that if we consolidate our efforts within the Department of Defense, that would allow you in industry to use the information that we have and provide us with quicker, cheaper products in the end. I think the advantages of this would be, in a nutshell, a singular research and development effort on the part of the Department of Defense, cost savings, obviously. I think it would be an excellent source of a world-wide data base capability with which we could accommodate sensors such as the GBU-15, both in temperate, mountainous, desert, jungle, wherever we have to use these sensors. The disadvantage, I think, is obvious and I'm sure a lot of you have thought of it, and that's adding another bureaucrat to the system and the management of it. But I think it's something we should look at and I think the Department of Defense would stand by and welcome any suggestions from industry on how best to accommodate this.

General Violett

Are there any questions?

Question

If we're going to build effective simulators for meeting the training requirements, we're going to need a theory and a method for translating those training requirements into engineering parameters. What work has been done and what work needs to be done on knowing how to do that translation?

Major Buckland

There are many efforts going on in that area. One of the problems is trying to characterize them in a coherent fashion. That's why I spoke to project 2363. Ron Hughes, in the back of the room, is working with a TAC . . . computerized modeling techniques to come up with at least preliminary answers from that domain. I've worked, and Dave Pohlman gave a paper yesterday and he's continuing that work on trying to extract the most that we can from our current digital technology so that we can bring in pilots and show them that, and show them what might be at least a gap filler for systems like the F-111 visuals. I think the ultimate solution, though, is the highly sophisticated, probably overly

expensive systems like project 2363, at least in the laboratory environment, so that you can demonstrate that you finally have more than enough and you can more accurately define how little you might be able to get buy with. In other words, you can bring in Tactical Air Command pilots and students and train them and see how much is enough. The problem we have had with ASPT is that it is, in most cases, clearly not enough and we need to get to the point where we have more than enough so that we can back off for the more cost effective, larger quantity type solution rather than one of a kind research device.

Question

(Cannot be understood)

Panel Member

From the viewpoint of the large body transport or the large body aircraft, the refueling simulator, I think, is essential for the B-52, the 141s, the C-130s, the E-3A - that relationship for those particular pilots and the costs of those systems suggest that we need to at least procedurally get into the area where you can go from an initial point of contact up to a pre-contact position on the tanker and know the relationship of that tanker in flight to that aircraft so you can fly it. Now as you get closer and closer to the vehicle, the fidelity of the simulator is going to be essential in maintaining the realism of the training and the task you're trying to transfer to the student in the cockpit. Speaking from the back seat of several fighters, teaching fighter type troops to refuel from KB-50s, KC-97s and 135s and now the KC-10s, I would suggest to you that a simulator gives you the opportunity in a classroom academic environment to run through the procedure and make him a little bit more familiar, and if you don't have excellent cockpit visibility, it can relieve the IP and relieve the system of a lot of severe safety problems. I think that the refueler simulator is essential.

Panel Member

That's an area where in many regards we already have enough, sir. Boeing had an excellent presentation yesterday on their part-task trainer simulator for aerial refueling. They've collected a lot of data and they've documented savings of several million dollars for training air-to-air refueling, and this includes TDY trips from . . . up to Seattle for the crews to get their training, so there is data available in that area.

Panel Member

As a PS to that, we're able to reduce the E-3A training sortie in that area by one sortie - instead of having two, we can live with one and at a cost of 8 hour sortie at about $6,000 an hour, that mounts up into big bucks in a hurry.

Question

For Colonel Robinson, sir, have you looked at transfer of training from your F-4 cockpits to . . . .

Colonel Robinson

I'll answer that by saying that my experience is that in the basic task, the three dimensional task, training VFM and this sort of thing in a cockpit that's not the same as the cockpit the person is flying - in fact, we have in the F-4 cockpit right now the flight performances for flying the F-15. I think you can train an F-15 pilot or an F-100 pilot or an F-4 pilot those basics of three dimension, where to fight your airplane, if you want to catch up you get the inside of the turn and down, and if you want to get behind you get up on the outside, those basic tasks are not related to the cockpit that you're sitting in. However, I think if you want to integrate those tasks in the situation that it is very important that you have the switchology to go along with that other mind training, procedural training. For instance, I think you could take an F-4 pilot and train him in an F-15 cockpit to a very high level of VFM because most of the F-4 front cockpit weapon switchology and so forth is external. The back seater does a lot of that. I don't think you could take an F-15 pilot and train him beyond those basic VFM tasks without having the switchology and so forth in there because a single seat cockpit has so many radar controls, so much to be integral to their thought process while they're also flying the airplane to an advantageous position. So the answer to your question, in a thumbnail sketch says yes, you can train some tasks, I believe, in the generic cockpit. I think if you want to do that three dimensional, four dimensional final combat engagement, one guy against another, then you really need the hardware in which he's going to fly and fight because you can do the job so much better.

Question

I'd like to follow up on the question of joint Service data bases for simulation requirements. I don't know if any of you are familiar with the Joint Logistics Commander's panel on digital cartographic data, but it's an attempt, both within the Air Force and in cooperation with the Army and Navy to work up joint requirements for not only simulation data bases, supporting data bases, but also for weapons guidance and navigation data bases from the Defense Mapping Agency. I thought I'd warn you that these gentlemen would be down probably visiting TAC within probably next summer and it will consist of representatives from Air Force Systems Command, NAVMAT, and DARCOM. So there is some effort going on in this field of standardizing joint service requirements for support for simulation data bases.

Colonel Murphy

We certainly would welcome that. The point I would try to make from the user is that it just doesn't filter down. It just seems disconcerting, from our standpoint, when we're trying to come up with hardware solutions that none of this information is available to us at any particular time. I would welcome these guys helping us out.

Question

I'd like to make a few comments on visual systems and how to exploit them. I'm from Boeing Company in Seattle and we're getting a rather high-priced, out-the-window CIG system. This is our second venture into the area. I was also on the committee that chose the first one back in 1974, and one of the problems we ran into at that time, we opted not to have an in-house modeling capability. Now, this time we are developing it. We have two people trained already in this area, and we've developed a very strong feeling that this technology will not be fully exploited until the user is able to do the modeling himself because the user usually has the super critic, the pilot, the trained crew member who can tell you if you're going in the right direction as far as putting the cues in that will do you the most good. Here we've fallen into the old mistake of confusing scene detail with scene fidelity and those seem to be two completely different things. So what we're trying to do right now is to develop our in-house capability. We'll be talking to the Defense Mapping Agency and other sources who may help us. We're also looking at automated techniques in this area. It looks like some of the modeling techniques are still very much in the stone age. We've seen the CADCAM capability and we've seen the very good stuff that can be done in the orbital reconnaissance area - stereo photos. We're going to look at some of these techniques and see if that can be applied to solving this visual problem. This is a tough problem.

Panel Member

I guess I'll pick up on that one, too. That's been the major way in which the ASPT has been able to address the more complex training issues, even though the visual system is limited in edge capacity. The in-house capability is absolutely essential. We couldn't have even begun to do the low level work we've engaged in without iterative process between our instructor pilots tactical, instructor pilots ATC, instructor pilots all working with the behavioral scientists and the engineers and programmers and the modelers to custom fit the data base. I think some of the commercial systems that have been fielded have had difficult problems specifically because of that lack and I think the automation is required in the future to address the world wide combat mission training, the huge data bases that will be desired by the operator in the future. You say a lot of the techniques are stone age now, but we're hoping for rapid advancements.

Question

I'm from the German Air Force and I have a couple of questions. In talking about the tactical combat trainer, assuming they will go into procurement, do you feel that a centralized use is better or do you feel that you should try to have one of these tactical combat trainers at the wing or squadron level? To put the question differently, do you see the main use for such a trainer in initial training to combat readiness or do you feel that even the combat ready, qualified pilot still needs to go, lets say, 20 or 30 hours a year into a tactical combat trainer to maintain or enhance his combat readiness?

Panel Member

Let me try as a starter, as the operator of one device, I think you need to break it down into what you intend to do with the simulator, whether you're going to train the basic tasks or get into the tactics area. Now, if you're going to train the basic tasks, you really need the simulator at the lowest level where you can use it day to day. There's a whole new field in the tactics arena where if you took a centralized group of cockpits that you could set up battlefield scenarios complete with the missile firings and so forth that Ron talks about. But that is probably not going to work out for your basic tasks for a couple of reasons. One is we've done a little research and I've worked on a couple of panels and if you try to do all your training centralized, you would have about one-third of your pilots on the road all the time, away from their units, which is a non-acceptable TDY rate firstly. Secondly, if you tried to get around that, you'd do all your training at the end of six months, so you'd block it up and you'd send the guy to this training facility for one solid month, which is, number one, not the best way to do training, because you'd cram it up in one end, and secondly, your guys are away from their units. So probably the end result is the best way to do it is to put the basic trainers at the unit level where it can be harmonized with your other continuation training and perhaps in the future, some sort of centralized facility where you looked at the tactical application, you may need to centralize that. But it would be something like a pre-Red Flag.

Question

I would like to follow up on the comment that the Boeing gentleman made concerning scene fidelity and scene content. Comparing the Air Force technology program to 2360 and 2363, Jack was mentioning the interest in the display technology. Project 2360 goals, air-to-air and air-to-surface, are very similar to those of project 2363. So I'd like to, I guess, ask the question in terms of emphasis. Is there a switching of emphasis from the scene content problem vis-a-vis the fidelity of the display, and the Air Force's attitude of looking at the procurements?

General Violett

I understand the question, but I'm not knowledgeable enough to answer it. But I think perhaps we have someone in the audience that can.

Questioner

The comparison I was drawing here had to do with, for example in the displays, 2360, as I understand it, was going to use the optics and the CRTs that we have on the . . . The image generation capabilities that we're attempting to put into Project 2363 have similar goals to 2360. So I'm wondering if there is a switching of emphasis from the scene content to the scene fidelity. problem.

Colonel Robinson

Speaking from a user point of view, I don't think the fellow who's in the cockpit getting the training really cares whether it's scene fidelity or scene content as long as the appropriate cues are there to allow him to train the task he wants to train. And that's something that, as a pilot sitting in the cockpit, he can tell you what he uses to cue from and I think it's up to the people developing the device to make that judgement as to whether he can provide that cue with a better scene content or better fidelity.

Panel Member

Interjecting from Headquarters, Systems Command, too, Warren, I don't really think the Headquarters cares either as long as it's better and in some regards that's for you to decide and the researchers at HRL and the engineers at ASD to come up with the better proposals to make the overall training effectiveness for the tactical pilots better. There's a perceived need in both areas, of course, for image generation and for display fidelity. I'd say yes, there is increased emphasis in both areas.

Panel Member

The emphasis on the display area is because this has become pretty much a limiting factor, more of a limiting factor, I think, than the image generator today, and I think as we look at image generators and look at scene content, I think we're at a point where we need to look at optimizing what's in the scene rather than just strictly providing more and more information.

Question

. . . limiting medium on the resolution, but in relationship to the image generator, with a total system evaluation I think both are important. But from the standpoint of the limiting parameters that you have in the IG and the data base system itself, versus those limiting parameters in the display, which is pretty

much isolated on the resolution problem. In other words, there are other limiting parameters in the total system that are important, also, in addition to the resolution. So do you see any limiting parameters other than the resolution that would cause us to put more emphasis on the display technology?

Panel Member

Other than resolution, the major area is to be able to provide the more dense imagery or to be able to provide enough imagery at any given point in the display so that you have a more realistic task in trying to acquire a target, in trying to maneuver against the target which generally has been driving us more and more towards the area of interest approach, where you can concentrate such imagery and make more effective use of the image generator. So how you mechanize an area of interest is another one of the areas of difficulty in display technology. How you mechanize it, where you put it, what impact this has on training.

General Violett

We're just about out of time. I would like to close by referring back to the question from the gentleman from Germany about the frequency of training. Whether it be basic or advanced, the assumption is that you have taught the individual what he needed to know the first time through. And if you had all of the training capacity and capability to do what you wanted as a learned outcome so that you had him at a proficiency level that was acceptable for some period of time, it's been my experience when you take the individual back to the simulator or back to the cockpit that if he was well versed in the task to begin with, he'll get back up on the step very rapidly, whether it's basic or advanced, whether it's at wing level or at a central location. So if you were to take the advanced simulator structure and were to make that central, as Joe suggested, make it pre-Red Flag or pre-Green Flag or pre-whatever flag for training the type people that are involved, if you had trained them well the first time through, then I would suggest to you that once a year would probably be sufficient if your flying programs also provided the number of sorties and hours that you wanted in that particular cockpit, because that's where you maintain it. If you want to enhance it, I think you need to get into the simulator, explore, experiment, develop the tactics and techniques that are necessary and then go reinforce it in the cockpit and learn it. So therefore, I don't think you need to get into the simulator every day, every week, every month at a local level in the advanced environment. You need to do that in the cockpit. So I would suggest to you that once every 17 months, as I said early on, going to Red Flag with hands-on was insufficient - we don't have a pre-Red Flag simulator, so that's unsatisfactory. We need something to be able to do that somewhere with some of the pilots on a once-a-year basis as a goal in my mind.

With that, it's been enjoyable. Thank you.

DECEMBER 2, 1981

CONFERENCE LUNCHEON

Mr. Merl

Two-and-a-half days of conference have gone by. When we started our discussions on Monday, I looked towards hopefully meeting several objectives. As I look back today, almost all of them, I think, were very well realized. We started off the discussion on Monday mentioning the objective of trying to achieve a better understanding between our industrial capabilities and the user community. I think certainly what we heard from General Otis, from the other user panels, other flag officers, really brought all of that into focus and I think all of our objectives there were realized.

In terms of looking at the technology that we had and the application of the technology to solve some of the training system problems, I think the attendance at the exhibits and what we had, in fact, to exhibit certainly bore those objectives out. I think this was an extremely fine exhibition of technology, along with the papers that were presented. So certainly, those objectives were realized.

Finally, in terms of having the simulation community get together, both with the users and the industry, if you were anywhere about the number of hospitality suites that were going well through the evenings, I think those objectives were well realized there and at the conference.

So from that point of view, I feel pretty good about things and I hope you do, too. I'd like you to know that aside from the key four representatives I introduced last night, this conference could not have been anywhere near the success that I think it is without the help of a number of people who have really worked very, very hard for a year now to make the things that seem to have fallen into place so easily really fall into place. And so I'd like to introduce them to you.

First of all, there was the Steering Committee and I'm going to introduce all of them to you, because they did a super job. The Chairman of the Steering Committee is Ralph Nelson, PM TRADE; Tom McNaney from NTEC; Dave Glenn from Air Force; Skeets Fairfield - I don't know whether he's here, but he really made things happen. As far as the program is concerned, probably the toughest job in terms of making a conference like this a success is the Program Chairman's job. John Todd, I'd like you to stand up. John's done a super job for about a year now to plan this whole program.

Other members who contributed so much to make this a success are the Chairman of the Management Subcommittee, Joe

Montalbano; The User sub-committee, Paul Pearson; The Logistic Committee, Pat Pollack; and Jake Wilfley, who really set up and planned this exhibits portion. The Technical Sub-committee was headed by Jo Anne Puglisi, who couldn't be here but did her part in organizing that part of the proceedings. Finally, the Chairman of the Publicity Committee, Al Collier. These folks really contributed to put this whole conference into the successful format that I think we achieved here.

At this point in time, I'd like to introduce our luncheon speaker to you. A very interesting gentleman. He's the son of a career soldier, attended various schools while growing up in Columbus, Georgia. He received his bachelor's degree from Emory University in Atlanta in 1965, and a master's degree in History in 1967; in 1970, a doctorate in Modern European History and both the master's and the doctorate degrees were from Tulane University in New Orleans. He was a professor of History and Environmental Studies at West Georgia College in Carrollton, Georgia for seven years before winning election to the Congress in 1978. He's now in his second term as Georgia's only Republican Congressman. Our speaker has established a reputation as an innovator, a challenger of the status quo, and one who can see through problems to solutions. I think you're going to find Newt Gingrich a very, very interesting speaker this afternoon. Ladies and gentlemen, the Honorable Newt Gingrich.

Honorable Newt Gingrich

Thank you very much for allowing us to come down. I am an Army brat by background and I was frankly slightly shocked last night by the invocation, partially because as an Army brat, it was such a delightful surprise to hear a Marine pray. But the subject of his prayer as it went on and he lost touch with reality, led me to call President Reagan this morning because as you know, he has a direct communications link with God. During his last conversation, God mentioned to President Reagan that he was listening to the prayer from Orlando, Florida, last night and was going to give it special attention, since he doesn't hear from Marines very often. But that the section that came after the P.S. was all garbled, but since it came from an Army-sponsored conference and this weekend has a very important game, he assumed that the Marine was concerned about the results of the upcoming weekend. The President's says - which I can't guarantee, because I'll have to let you decide how well President Reagan understands God's wishes - the President says that God wanted me to pass on that he was taking Army and giving 14.

I'm curious - how many of you joined me in firing the DRAGON system out here? I'm surprised more of you didn't. It's a great system and I commend it to you. Like most of you, I assume, I fired it directly into the ground on the first launch and it was very inspirational and adequately humiliating. As a Congressman, of course, they eventually rigged the system so that I actually hit the tank. They did this partly by bringing

the tank in close enough that I could kick it. But after firing the equivalent of $25,000 in rounds, I managed to score a hit, which I'm keeping and taking home to show all of my friends.

Then for public relations purposes, they took me over to the NEWTS system, which many of you may know is the Naval Electronic Warfare Training System. Since my first name is Newt, they thought it would be a great gimmick shot and the computer promptly flunked me.

But the most interesting experience, and I don't know how many of you noticed this - raise your hand again if, like me, you fired the DRAGON. Now, raise your hand if you played any of the hotel games. I was amazed that no matter how late in the night you went walking by there, there was somebody either in uniform or in a suit playing one of the Atari systems. I also want to say that probably the most impressive single thing out of this effort to communicate through a variety of reception rooms and what have you, was the simulated sobriety and pleasure each morning. No matter how bad the hangover was, people would get in the elevator and stand straight.

I looked at the proceedings. I thought it was a very impressive conference. I'm not an expert in a lot of your areas, and frankly, some of the proceedings I didn't understand because the math was over my head. But overall, the range of information, the time I spent yesterday talking with people and looking at systems and again this morning, it's an impressive conference, it's an impressive volume of proceedings, there are very impressive displays out there. I listened on tape last night to a series of impressive speeches by General Otis and the other flag officers who opened up your general conference on Monday. I thought that the emphasis on speed, practicality, cost, were exactly right. I think this conference is exactly on target. And I think, frankly, that all of you, and I include the Congress in this, are engaged in a national scandal.

I want you to think about what you've seen here for the last three days. The quality of the systems - the engineering ability - the sophistication of the break-throughs. Think about the fact that while we sit here in Orlando, Florida, near Disneyworld eating a good lunch, there are young American boys driving M-113s around Germany. If you have this quality potential and you have that quality output, I think it is the most fundamental scandal in this society that we have a Defense system, starting with the Congress and the President and the American people, going back through the bureaucracies of the civilian OSD, and the civilian secretaries down through the uniformed services to the procurement people to the corporations to the labor unions, that we have the capacity to produce Atari for every one of our families this Christmas and we're allowing American men and women to serve their country standing in the rain with equipment that is now 30 years old. I think every single one of us ought to be ashamed.

When you go home with great sense of success for this conference - and it is a successful conference - I want all of you to reflect on the degree to which, candidly, we micro-managed brilliantly and we strategically managed a disaster. No matter how well any one system works, this country as a whole is in tremendous trouble and we are far closer to Chrysler than we are to the American military of World War II in our likelihood of surviving successfully in the next generation.

The truth is, that for 36 years we have relied on dominating the escalation ladder to survive with minimal investment in national security - minimal investment economically, minimal investment in manpower, and minimal investment in courage and in career development. Everyone who takes war seriously knows that we're in serious trouble but that each person micro-manages their own zone and then blames somebody else. So the Congress holds hearings and proves that the Army or the Navy or the Air Force or the Marines are incompetent and then the officers go back to the club and have a drink, reflecting on what idiots Congressmen are, and both of us blame the news media, which can't find anything except the worst of scandals. And yet military defeat will know no scapegoats. It will only know victims.

We focus on micro-management because people feel helpless about large-scale change. They say, "What can I do? You can't beat the system. It's not my job." The truth is, in a free society, national survival is everyone's job every day. General Houser told me that in Germany he has a 48-hour rule - that his real goal with obsolete equipment, inadequate ammunition, inadequate training grounds, and lack of money is to be prepared for a war within 48 hours. The truth is, that in 48 hours we lose any war, anywhere on the Eurasian continent with the Soviet Union. That's not just my personal opinion. Recently I asked 25 field grade Army and Air Force officers, in different meetings at different times, off the record, if you had to plan a war in Europe or in Iran or wherever, on the Eurasian continent with the Soviet Union, which side would you rather plan if we were going to shoot you if you lost. The score was 22 for the Soviet Union, 0 for the United States, and 3 refused to choose on the grounds that they're patriots. Now, that should sober every single person in this room. It ran from a two-day defeat to a nine-day defeat, that was the span. That's assuming no chemical assault, no initial surprise, and no nuclear start on the Soviet side.

The rapid deployment model I think is a tragic joke. It guarantees a large enough force to get us into a war we can't win and too small a force to do much once we get there. In Europe we have created a Bataan Peninsula defense force. In the rapid deployment force, we are creating the Athenian expedition to Syracuse. The fact is that the military establishment of this country, including its civilian counterparts, is dominated by a theology and sociology that rejects subjective

reality in favor of whatever is useful to believe. We can't stop competing with the Soviet Union, but we are not willing to take war seriously enough to guarantee victory. The most useful parallel may be to Prussia before the battle of . . . when everybody who was studying the French Revolution understood what the Napoleonic Army meant, but none of them could get Prussian society or the Prussian monarchy to take reform seriously. I'm willing to say flatly that without fundamental reform, there are no meaningful wars we win in the near future.

Fundamental reform is more than just the Secretary of Defense or the Army or the contractors or the Congress. The Prussian military reform that worked was a societal reform, not the bureaucratic reform. It reflected fundamental changes in the nation, not just changes in the Government. The Israeli defense force, the most successful modern defense force since World War II, is based on the nation, not on the Defense subcommittee of the House Appropriations Committee. Our societal shift must be from a liberal welfare state, which frankly is not survivable in the late 20th century, to a conservative opportunity state that would be survivable.

I hope all your tables have one of these papers. We passed them out because what I'm going to say sounded a little bit academic and I thought it might be helpful to have a real model of what I'm talking about. It also has a place at the bottom if you disagree strongly enough or agree strongly enough that you want to pursue this, you can fill it out either now or later on.

My arguments are very simple. It is that a free society is governed at four layers. I'll go through them very briefly. We are in the midst of a transition from a liberal welfare state to a conservative opportunity state and that that shift is probably inevitable and the question is whether we'll do it very well or very poorly. If we do it very well, then we'll resemble Japan in the last decade. If we do it very poorly, we'll resemble Britain. But the shift is going to come anyway, because it is the nature of technology. That the shift is being driven by three fundamental revolutions - a revolution in biology, which is going to affect food production and health care more than anything we've seen in the last century -- a revolution in space, which is, in fact, the next frontier -- and a revolution in information technologies, everything from television and cable through computers and simulations. That those three revolutions are comparable to the rise of electricity and the internal combustion engine in the 1870s and 80s, and that they will have as fundamental a transforming affect on our society in the next 30 years as that revolution did between 1870 and 1920.

The way change occurs starts with the bottom of the page, not the top - the world view, values, what do you believe about reality. To put a simple example, liberals have a tendency to

believe that crime is a function of bad childhoods, that if you get mugged the mugger probably had a bad relationship with his mother or his father or came from a bad neighborhood, and that you should feel sorry for the mugger, because if they were only better adjusted they would somehow not have mugged you. A conservative vision of crime would say that muggers are dangerous, whatever their childhood was like, and you frankly don't care what they were like when they were 12 - at 27 they're very bad. The liberal view, then, would lead you to a paradigm or model - it doesn't help you in life just to believe things, you have to have a way of living them out, so that a legitimate liberal approach to crime is to say what we need to do is somehow have a therapist who will help the mugger work out his childhood fears. The conservative would say, what we need to do is have a guard to help the mugger not mug me again. What you would then get in society is a triangle of special interests. This is a concept that goes back to James Madison and the Federalist Number 10, so it's not anything brand new, and that basically says that all human beings have interests. As Madison says, the key - and this is a real debate between people like Ralph Nader, who are fundamentally arguing for a totalitarian society in which the only interest that is allowed is theirs, and that to talk about special interest is bad. Madison argued that special interest is very real, it is very normal, everyone has them, and the way you protect a society is to bring them out in the open. In Washington we created a triangle. One side of the triangle is the Congressional Sub-committee, the second side is the special interests group, and the third side is the federal bureaucracy. So that, for example, on crime, if you're a liberal, you end up with a national association of prison therapists and they come and testify in front of a liberal sub-committee which has a liberal staff which sets them up and they say, "The Reagan budget cuts are horrible. It's going to make people feel bad," like the woman in Pennsylvania who said that she was sure she was going to abuse her children because of the budget cuts. It was on television - it was a real story. The woman walked in and said, "I feel so horrible about these budget cuts that haven't happened yet that when they happen I will probably beat my children and it will be all Ronald Reagan's fault." That was set up. They had a liberal staffer who went out and found her and said, "Why don't you come in and tell us how horrible the President's budget cuts are," and they lined it up and had a liberal sub-committee that heard her come in and say that she was going to be a child abuser and it was all Reagan's fault. So those of you who are against child abuse obviously are against the budget cuts.

Now, that's a legitimate way to distort the system, and that legitimately is how the game is played. One of the reasons the President's program does not come across better than it should is that we currently have a liberal establishment running from CBS News through Claude Pepper's Committee on Aging, to various liberal interest groups and so you take Reagan's steak and it becomes liberal hamburger by the time it gets through

the meat grinder. And you end up with a cycle and what you have is probably the best communicator since Franklin Roosevelt engaged in a duel with an entire system, which has now had a half century to try to dominate this society. Ultimately you end up with candidates like myself. What we do is we take the language pattern of a world view to explain a model to an interest group in order to get re-elected. So that, for obvious reasons, if you run in Miami Beach you are more concerned with aging than if you were running in Ann Arbor, Michigan, where you have 75,000 students. And you have more concern for student loans if you are running in Ann Arbor than you do if you're running in Miami Beach.

That's not totally true, and the grandparents care about their grandchildren, and the grandchildren care about their grandparents, but to a significant extent it is true that specific triangles tend to dominate politics, particularly in the House and the Senate. At the Presidency, world views tend to dominate.

The problem you have then, in that framework, is that for the last half century we have had a world view which dominated us which originally started off and said, under Roosevelt, two things: one is that when things get really bad, the Government should step in; the other is that when the world gets really dangerous, the United States should step in. He said that very tentatively and very cautiously and we built a New Deal around them. By the 60s they had been transformed into the Great Society which said that the Government ought to step in pretty randomly, and by the Kennedy vision that we will go anywhere and pay any price to protect freedom, which had been translated into, "The U.S. will step in randomly." Now, those two visions were so unsustainable that ever since 1968, we have been trying to get away from them. We keep zig-zagging wildly because we have not been able to create a systematic model of behavior that explains to us how to survive as a country. One of the great dangers the Reagan Administration faces is that if all it is is the destroyer of the liberal welfare state, in the end it loses, even if Reagan personally wins. But the country will not destroy the liberal welfare state to replace it with nothing. I am suggesting that what we have to do, instead, is invent the conservative opportunity state. Let me give you a couple of specific examples and run them through from world view to candidate.

One of our world views is do you want to change from the teacher to the learner, that instead of saying how do we improve teaching, you want to say how do you improve learning. That fundamentally changes all sorts of questions that you ask. And many of you are involved in this business so you may understand exactly what I'm talking about. Your real goal is to have people who can read, not to have people who can teach reading. It's important to remember which of those you're after. From that standpoint, we're going to propose a bill which is for a home, office, and learning center. Basically, it is going to say that you can take a tax credit of up to 50 percent up to $100 credit

per member of your family per year for any system you buy that is learning oriented in the broadest sense - an Apple computer, a Texas Instrument Speak and Spell, Honeywell, and you can take it on a given purchase for up to five years; that is, if you bought a $4,000 system for a family of four, the Government would pay half of it off in tax credits over a five year cycle. The reason is, we think that you want to move the entire society to be learner focused. I think, for example, that we ought to try to have an opportunity somewhere next summer and see if we can't get every child entering the first grade to be able to read before they walk in. We clearly have the technology to do that between television and neighborhood voluntary associations and things like Speak and Spell. We could do that if we could mobilize ourselves as a nation. Second, you want to have people in the habit customarily of using information technologies because if we as a society became the first society on the planet to have total literacy with computers, we would have an advantage over our competitors as great as the advantage we had in the 30s because we were the first society to have democratization of the diesel and internal combustion engines. That ought to be a long-term national strategy designed to build up the speed of acceptance of information technologies into this country by making it profitable - notice these are very conservative concepts - by making it profitable for the individual, for the individual family, for the local person to engage in that behavior. Not by setting up a large bureaucracy, the Federal Department of Computer Technology, but by building market incentives, in effect, the Homestead Act of the 1980s and 90s.

Second, we have to go into space in a large way. One of the reasons the space shuttle costs so much is that we're not willing to spend enough on it. Any of you who have been project managers know that the best way to guarantee a really expensive project is to stretch it out and starve it. We would have built the space shuttle faster and cheaper, had we spent more on it. I'm going to recommend and hopefully attempt to offer next spring an amendment to have a $9 billion NASA budget for FY 83, rather than a $6 billion budget, because the faster we move into space - I'll give you one example. McDonell-Douglas and Johnson and Johnson, the baby power people, have now joined together to build a factory. They're going to put up an experimental factory with purely private capital in 1985 to produce interferon. It is their belief that they can produce it 300 to 400 times faster in space than on earth. It potentially will allow us to dominate the entire world market for that drug. It will potentially create 50,000 jobs in the United States, while creating 20 jobs in space. We have not had a tariff in this country as a protective device since World War I, in a way that really worked because we've invested in research and development. Research and development money was the tariff of United States industry for the last 30 years. It gave us the marginal advantages that allowed us to dominate world markets and I think a

prudent conservatism has to focus on opportunities, not just cheapness.

Third, there has to be fundamental welfare reform that says basically if you're under the age of retirement and you're able-bodied, you show up on Monday morning and the Government guarantees you a job at minimum wage, and if you get fired three times in 90 days you're out of the system for six months with no help at all. Until you change the game to restore work to its primary place and to ensure that noone who is able-bodied cheats off the system, and that would mean frankly that welfare mothers would then go to child care centers just as middle class mothers do - they would drop their children off and go to work. Until you do that, you cannot fundamentally break the cycle of poverty in the culture or poverty in the central cities of this country.

Let me apply that magnitude of change to national survival, to your business. One, you absolutely have to have universal military training in the 80s. There is no viable scenario dealing with the Soviet Union in which they don't simply outlast us and outweigh us. I personally suggest universal military training rather than the draft, because I think as a society for the long run, it's easier to sell. I think you can get the draft through the Congress easier, but you have so many problems of equity and decency, and I think in the long run you want every American to have at least some experience of the realities of world power and of the realities of a dangerous world. Let me be very candid. I don't mind demonstrators who are against nuclear war. I think it was the stupidity of the United States for years to allow ourselves to be placed in a position where those demonstrators thought we were the people they were demonstrating against. I understand we have some protestors out here today who have signs that say, "Give Peace a Chance." I'm in favor of giving peace a chance. My father gave his entire life for 30 years to serve this country giving peace a chance. I'm in favor of giving them all the help they need to translate their signs into Russian. I'm in favor of us offering to ship a routine percentage of demonstrators to the Soviet Union on a regular basis. I believe we ought to have national rallies against nuclear war such as we had recently across the nation, and my only request is that the Government offer to pay for satellite transmission to the Soviet Union. I'm not at all concerned about confronting any peace demonstrator or any Quaker or any pacifist anywhere and saying very simply, "Had you been successful in the 1930s, not only would there be no Jews left on this planet, we would be dominated by Nazi Germany and by a Japan far less desirable than the current model. If that's a world you can accept, fine. Then you ought to believe what you believe and you ought to demonstrate for your beliefs. Just don't kid people about the consequences of that behavior. It means the survival of barbarism because in the end they kill pacifists." The only reason we're allowed to have pacifists on this planet is because one silly country in 1945, when it had an absolute monopoly on nuclear weapons,

voluntarily walked off and said, we'll protect you but we won't conquer you. I have no sense of shame for that record.

What I am about to say is very radical. For those women and men who appropriately do not want universal military training in a uniform service, I suggest that we build a very large civil defense corps in recognition of the reality that someday sooner or later some nut is going to have nuclear weapons and we ought to be prepared to survive, no matter what anyone else does on the planet, and that a vote against civil defense is a vote for deliberately allowing your people to die. And also, I want to suggest, a very radical thought, that we very seriously consider as part of a universal military training program having certain basic production facilities that are manned by people who are signed up for a year or year-and-a-half under universal military training to produce some systems in such large quantities that, in fact, we again get cheapness. You can afford, for example, a lot of training rounds for 155mm ammunition if you use part of your universal military training pool to produce those rounds. I think we have got to get back to a system where we have such large production runs of equipment, at least basic equipment, that we have live fire. Those of you who don't think that's important, I suggest you look at the Japanese torpedo in 1941 and the American torpedo in 1941. They paid enough to actually fire torpedoes at real ships. Theirs worked. We didn't pay enough, ours didn't work. It took us two years in World War II to get torpedoes that worked. I don't think we're going to have two years to play with next time.

Second, the Armed Services have got to focus on the National Guard, the Reserve, the ROTC as the skeletal structure within this society for understanding reality in the world at large. In many, many ways, our professional leaders have been, I think, eating up the seed corn of their own future by underfunding the Reserve and Guard and by giving them less attention and less honor than they deserve. I think that the system ought to be based on the Reserves as the first component after you build an Officer/NCO cadre system, and revert back to Douglas McArthur's papers in the 1930s. You have to have a cadre of professionals first, because they're the hardest to replace and take the longest. But you want, second, a tremendous Reserve system, even if it means you take away from immediate readiness. For two reasons - one is in the long run, immediate readiness doesn't buy you anything. It buys you at the most, four or five days in Europe. The second reason - if you have a large decentralized Reserve and Guard system and a large ROTC system, you have penetrated the society at large with basic information that has to be out there in a free society. If you're going to survive. One step I would suggest towards that is that we ought to have a simulator center within two hours of every National Guard, Reserve or ROTC unit so that people out there, instead of going into a classroom with a chalkboard are having some real sense of what it would be like, are having a real sense of excitement. Coming back from that weekend training having done something that was more

exciting than their friend who went fishing or played golf. Those centers, in terms of morale and esprit de corps and elan and recruitment figures and readiness would do more to give us a real surge of support for the Reserves and National Guard across this country than anything else I can think of that we could do, and that kind of large-scale change is necessary if you're going to have an adequate Reserve for the 80s and 90s.

Third, we have to have fundamental, deep, decisive shift in procurement. Let me go back to this paper for a second, and I'll give you an example of what I mean. When we talk about reform in this country, we normally mean inside this triangle - that we're going to micro-manage slightly better, that we're going to get an incremental change. Colonel Campbell was telling me yesterday that we had gone from the 1920s to the 1980s, from 8 to 459 steps in the Army procurement process. You used to have 8 people who could say no, you now have 459 people who can say no. And that explains a lot of our current problems. Well, normally, reform means we go from 459 to 456. Let me just suggest to you that level of modification is trivial and not worth the energy. It's useful for you and you ought to do your jobs, but it fundamentally is not worth the energy for the society. I would suggest that what you want to do, and again, what I mean by a shift in world views and models, going from a stagecoach to a slightly faster stagecoach is a change within a triangle. Going from a stagecoach to a transcontinental railroad is a fundamental change at the world view level. We want to fundamentally reform the procurement system of this country with two goals. One is, at worst, to have a procurement system that is inside the decision cycle of the Soviet Union, that is, that allows us to acquire their latest system and respond to it faster than they can field the next generation. As you all know, we're now in exactly the opposite situation. They can actually respond to us 2-1/3 to 3 generations within each of our new systems, if we ever get the new system funded. Second, our ideal - our worst case should be able to respond, procure, R&D, analysis to R&D to procurement to fielding faster than the Soviets. Our best case should be to respond at least as fast as the commercial market. I would suggest to you that you look at the TV games that were offered last year for Christmas and the TV games that are offered this year for Christmas, look at the rate of change in that market out there and then you look at the rate of change in the systems you're dealing with, and it's enough to make you cry. I don't blame any of you. I'm talking about a genuine, society-wide, fundamental problem.

As one radical step, let me suggest one particular area I know we have a problem in. We need a new anti-tank round for the 105. Everybody knows that. Everybody says it. Everybody also knows we're not getting it and there are all sorts of good reasons we're not getting it, none of which matter if you don't have it. I would like to propose that we figure out what it would cost the U. S. Government to field, to do the research and development for a new round, assuming one could be invented, and we

offer half that cost as a prize. If it cost $12 million, we ask DARCOM to say what it would cost for them to do it. You take half that figure and say we'll have a shoot-off once a year. Anybody who wants to can apply. The only question is, does it fit in the gun and does it hit the target and does it meet the criteria - here are the nine criterion to penetrate the T-87. Shoot it off. It is worth it to this country to pay $9 million for the first round if you get the first round. And then you can build the next 6,000. But if you can't even get the first round, it isn't worth anything to the guy out there who's going to die because he can't penetrate Soviet armor.

I would suggest that we need those kinds of fundamental break-throughs where literally six months from now anybody in the country who wanted to show up could go through the first screening. Then anybody who was within the general characteristics could try it out and then we'd pay for the royalty, we'd pay for the patent on the round that worked. That way you could have 12,000 chemistry professors out here wandering around reading science magazines playing games, and if they want to show up, fine. It would be shocking, but in fact you can go back through the years and find all sorts of people, starting with the letter to Orville and Wilbur Wright explaining why the Army didn't want the plane, because they had studies to prove it wasn't existing. And I suggest all of you go back and read their correspondence, if you think I'm kidding. Their correspondence with the Ordnance Board was hysterical.

Fourth, we need a new strategy for Europe and it's a very simple strategy. It's based on a maneuver of warfare and all of you will say, I'm sure, that there's no room for maneuver in West Germany and you're exactly right. There's no room for maneuver near Tel Aviv, either, and the Israelis have solved that problem. You always fight a war of maneuver on your enemy's territory. It makes it much easier. You don't worry about collateral damage. And the American doctrine in Europe should be very simple. We do not want war. We intend for war not to occur. If it occurs, we will fight it starting within the opening day inside East Germany and Poland and Czechoslovakia, and we will do so very, very rapidly with forces that we liberate and tell them to go run like crazy, and we'll have them all equipped with transmitters and with people who speak in Polish and Czech and German. There may even be a helicopter unit or a paratrooper unit near Warsaw trying to take over Radio Poland. And I'll let the Russians worry about what they do with Polish television, that shows an American unit inside Poland, even if it's only nine guys. And then I'd bring the Russians in and show them war plans and say, if you want to take the risk that the Russian empire gets torn apart, that's your decision. We personally prefer not to fight, but we want you to know that if the game starts and anybody decides to use nuclear weapons, they decide to use them in eastern East Germany and not in western West Germany. That changes, I suspect, the whole psychological morale

of NATO. It also poses problems for the Germans, but I think we simply have to take the position that the United States is not ever again going to plan for a defensive war in which, by definition, our Army would fall apart. Because you can't fight a war of withdrawal under pressure in the opening week of combat. It is not psychologically possible.

Let me say, finally, that in terms of where we need to go, our goal has to be very simple. We want peace. We will prepare for peace. As George Washington once said, if you want peace, prepare for war. If war comes anywhere on this planet and our national interests are involved, the one thing we will demand of our professional military is victory. Period. Not explanation. And the Congress then has a new job and this is where you come in and this is why I wanted to come down and talk to you. The Sam Rayburn model of Congress is collapsing. Half of all members of the House are freshmen or sophomores, two-third of all senators are freshmen. There is an entire new world opening up in the Congress. That generation has to learn from a new model how to behave. We can't continue with the same kind of micro-management in the Congress, the kind of shooting fish in the barrel, press fantasies that allow Congressmen to feel good and the country to decay. We have to build to go along with our conservative opportunity state a grass roots Congress in which each of you takes on yourself the responsibility of educating the members you know. Even active duty soldiers have the right to visit old friends who are Congressmen. Even active duty soldiers have the right to go and see the man who they vote for as constituents, not to lobby on Army policy but just to talk about reality. Not to go out and say anything in public, but just to say in broad, general terms, I thought you ought to know what I do for a living and what you pay for. Every industry that is on exhibit here has people who work in Congressional districts and those people ought to show up and educate their Congressmen. I've seen groups that applauded and were grateful because a Congressman who voted against them showed up at their cocktail party. Being a Congressman has to be as much of a business as any other business. You have a contract. You hire me for two years. If I don't do your bidding, you ought to fire me, and you ought to make sure that I understand during the two years what your bidding is. If I decide I can survive without you, that's my gamble. And if you can't beat me, you'll get real frustrated. But if we return the business of self-government to being a business, and if you do your jobs through your communities and your neighborhoods and your trade associations and the people who work with you, and you make sure in the broad sense - the problem that we've got right now is that almost every interest in this country goes out and worries about its particular triangle in the narrowest sense. How do I sell my program and if I go and see my Congressman, will that upset the Army or the Navy or the Air Force, and then will I not get my contract? So nobody's out there selling the world view and explaining why we need a lot of programs, of which some will go to your company. We have to fundamentally focus on shifting

the entire world view. Your jobs are simple. One, if you agree and believe in a world view, which is essentially a conservative opportunity state, based on adapting to and anticipating the revolutions in technology, based on national survival, based on the idea that individuals should work and that we should have decentralized decision-making as much as possible, then you ought to spread that world view. Second, you have to help invent the hundreds and hundreds of models. I can't possibly write a procurement bill. That's not an idea I have any expertise in. I can't possibly design a universal military training bill. I don't know exactly where we ought to go in detail. That's not my job; that's yours. But if you invent the models that make sense in that conservative opportunity state, I know how to get them out there. I know how to get them explained and I'm capable of introducing them in the Congress. Third, you have to build the iron triangles. The American Defense Preparedness Association, the Association of the U.S. Army, the Navy League, the Retired Officers Association - all the groups that favor America's survival in a dangerous world have to become more visible, have to have larger memberships, have to be more militant, have to be more aggressive. We need a Ralph Nader of the right. We need people who are willing to stand up and say to Jane Fonda, "Those are great ideas and look at Cambodia. That's your responsibility." Until we get people willing to fight on the right and willing to be on the Today Show, and willing to be out there being aggressive, and being willing to live in the battlefield of ideas in a free society, we're going to remain in trouble. In that sense, all of you have a capacity to help build iron triangles that will fundamentally change things. For example, when we introduce this bill for a home office and learning center, if we can get a national association that's an umbrella association for a home office and learning center, and we could get everybody who saw any advantage to themselves or their family or their neighborhood or their community by getting that kind of a tax credit to allow them to buy those kinds of equipment, to join that kind of thing, then you create a new right-of-center counterbalance to the kind of groups that have dominated this society for the last half century.

Fourth, each of you is a citizen first. You can talk to people. You can make a difference. We're really fortunate in this country. If we do shift from a liberal welfare state to a conservative opportunity state, if we do take advantage of the incredible explosion in the information technologies in space and biology, we have the potential genuinely to do what Woodrow Wilson once talked about. To create peace. To make democracy safe. We have the potential to lead an entire planet to a world in which every citizen of the planet has a chance to learn, a chance to produce, a chance to be free, a chance to travel, a chance to communicate. The reality is in the great long-term competition of ideas that the Russian empire is decaying - not just decaying in Poland. The Russian empire has an alcoholism problem that is comparable to a cholera epidemic in its impact. The Russian empire has a declining male life expectancy. The only society on earth

in which there is actually a declining life expectancy. Brezhnev faces a crisis in the economy that will worsen throughout the 80s. There is only one area that the Russian empire does better than the American. There is only one place where the Soviet Union is more effective than the United States. That area is the willingness to commit national resources, money, manpower, spirit to fighting wars. The only place left in which the Soviet Union has any hope of competing with the free world is the ability in three weeks' time to win a war. The challenge to you and me, to all of us, is to recognize that Ronald Reagan will not save the United States. Cap Weinberger will not save the United States. That Newt Gingrich isn't going to save the United States. That at any day from now through the 80s until we finish this transition, literally at any day, war could begin. That if it began right now, we collectively would send our boys into war with obsolete equipment, with inadequate ammunition, with inadequate training, with inadequate doctrine, with an industrial base that is not capable of delivering, with contractors who are behind schedule, with a Congress that wouldn't understand. Each of you is a free citizen, has a chance to join in. Each of you has a chance - in every decision you make, literally, for the next decade - to marginally increase the survival of the United States. To choose again and again between the easy, soft, immediate thing that might help you but hurt the country and fighting with professional integrity at whatever level you're at - as a salesman, as a project manager, as an officer, whatever level you're at. Fighting for the right thing for this country's survival.

What I ask of you as we go through this decade of transition is every day when you face those decisions, whether to risk your career and do what's right or back down because it's after all more acceptable, ask yourself this about the survival of this country, the survival of your own children, the survival of the freedom you've inherited. If not here, where? If not now, when? If not me, who? Free societies survive when the free citizens decide it will be me. I can make a difference. Each of you can make a difference. The decision is up to you. Freedom, prosperity, literally for centuries, is at the doorstep of this entire planet if we have the courage as a nation, if we have the courage as individuals, making up that nation, to invest ourselves in a decade of change. Thank you.

<u>Mr. Merl</u>

Newt, thank you so much for a really stirring address. If we became a little comfortable with the successes that we saw here, realized here, it certainly shook us up. You gave us a lot to think about. If not me, who?

Before we close this conference, I'd like to turn the podium over to Captain Nelson Jackson, U.S. Navy, Retired, for a few closing remarks for the American Defense Preparedness Association.

Captain Nelson P. Jackson

Well, the first thing I have to say is that having spent most of my adult life in the Navy, and on occasion I think I communicate with God, I have found that God is always right and sometimes I don't quite read his transmission correctly, so I would suggest to you before you take Army and give 14, that you realign your communication link.

I would just like to say on behalf of General Miley and the Association, we appreciate everything that has been done to make this a successful conference. I would like to recognize this hotel, which has done such a splendid job of management.

You already heard about those people who have done so much and I would like to give a little outward and visible sign on behalf of the Association to some of those, not to all of them because we just don't have that time, but would John Todd, Joe Montalbano, Ralph Nelson, Kurt Merl please join me here on the podium. We have a certificate of appreciation - in recognition of outstanding service by each of these gentlemen for the period in which they have served. It says: The American Defense Preparedness Association presents this scroll in recognition of dedicated service and outstanding contributions that significantly aided the growth and effectiveness of the Third Interservice/ Industry Training Equipment Conference. We're sorry that Paul Pearson has departed and Jo Anne Puglisi did not get here, due to other commitments, but they certainly will be recognized and their certificates will be forwarded to them.

And now to that Program Chairman that you've heard a lot about and who has really been the substance of this whole affair, we would like to present this plaque to John Todd which says; Presented to John A. Todd, Program Chairman, Third Interservice/ Industry Training Equipment Conference in recognition of his management of an exceptional program.

Mr. Merl

We've reached the witching hour. I'd like to thank everyone for their support and I am now ready to turn the gavel over as Conference Chairman to next year's Chairman, Jim Gardner, who will be the Conference Chairman for the conference next year.

Mr. Gardner

Just a few brief comments. I'd like to remind you again of the 1982 Interservice/Industry Training Equipment Conference. It will be held on 16-18 November here again in Orlando. Next year's conference will again emphasize the user, and we are soliciting your suggestions for next year's program and would encourage any of your ideas. The formal call for papers will be mailed to all the participants in this year's conference and sometime in late January. You already have a preliminary call

for papers and we would encourage you to start thinking about papers today. There's going to be a great deal of competition for next year's program. We can't accept all papers, so start thinking about it early. We think it's going to be at least as good as this year and we hope we can even improve it.

The conference next year will be sponsored by the National Security Industrial Association and the Navy will be the coordinating agency. Since Captain Jack McHugh will be the Executive Chairman of that conference, let me introduce him for just a moment to make a few comments about the Fourth Annual Conference.

Captain McHugh

Ladies and gentlemen, I'm up here for only one reason and that reason is not really to accept the challenge for next year, which I think is going to be something that we're really going to bear down and do one fantastic job to beat the success of this year's conference. I've been very impressed with the speakers and the way the people attended the conference and the total participation by everybody. I'd like to say to the Congressman, we do have an iron triangle. We have the Army, the Air Force, and the Navy, and we work very well together. I'd like to say I'm not skipping the Marine Corps. Thank God they're part of the Navy. In any case, I think the challenge is very real to us. We see the challenge, we've stepped up to that challenge before, and we will in the future. I think that the cast of characters that participated this year, the speakers in particular, have been exceptionally fine and I'd like to personally welcome Colonel Reddenbacher to our clan, as far as participating for the first time this year, and hopefully the participation will continue through the future years. I'd like to particularly thank Don Campbell, because he's done a fantastic job in bringing the Army in here in force. I think you all deserve a well done.

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DRCPM-TRD-PC
ORLANDO FL 32813

37276
PAUL MARTINET
XEROX
MGR ADV TRAINER & SIMULATORS
300 N HALSTEAD ST
PASADENA CA 91006

27332
ORIN E MARVEL
HONEYWELL INC
TRAINING & CONTROL SYS CTR
1200 E SAN BERNARDINO RD
WEST COVINA CA 91790

42676
DANIEL MASAKI
HUGHES AIRCRAFT COMPANY
SYSTEMS ENGINEER
1901 W. MALVERN
FULLERTON CA 92634

45957
CHARLES E MASALIN
ORI INC
DIV DIR
1400 SPRING ST
SILVER SPRING MD 20910

46449
LOUIS D MASIELLO
US AIR FORCE
CHIEF AGE & TRAINING DIV
HQ ESD DEPUTY AWACS/YWEG
HANSCOM AFB MA 01730

43148
LTC JOHN D MASSON
DIR FOR CONTRACTS DEP FOR SIMU
USAF ASD/YWK
WRGT PATTSN AFB OH 45433

47407
BRUCE W. MASTERS
U.S. ARMY
PROJECT OFFICER
HHC 7ATC
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42681
ROGER H MATHEWS
MCDONNELL AIRCRAFT COMPANY
CHIEF ENGINEER, LAB
PT 1, BOX 79
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47450
YOSHIKAZU MATSUMOTO
JAPAN RADIO
ENGINEER
FUNABASHI, JAPAN
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43150
C E MATTLAGE
VOUGHT CORPORATION
ENGINEERING PROJECT MGR.
P O BOX 225907
DALLAS TX 75265

46021
MARC M MAUPIN
LITTON DATA SYSTEMS
TRAINING MGR
8000 WOODLEY AVE
VAN NUYS CA 91409

43151
ROBERT M MAURER
SALES MGR MARINE SYSTEMS
KOLLMORGEN CORP
347 KING STREET
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46254
JEFFREY L MAXEY
APPLI-MATION INC
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32832
GEORGE MCALEER
DEF. SYS. MGMT. COLLEGE
BLDG. 207
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46161
MICHAEL MCCALL
USA FINANCE & ACCT
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USAIS
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46612
LTC MCCARTER
NAVAL TRAINING EQUIP CENTER
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20803
GLEN MCCARTNEY
INTERNATL LASER SYSTEMS INC.
3404 N. ORANGE BLOSSOM TRAIL
ORLANDO FL 32804

42697
GEORGE T MCCASKILL
LARGE LINE OF BUSINESS MGR
PERKIN-ELMER
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46616
J MCCONVILLE
NAVAL TRAINING EQUIP CENTER
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46260
TERRY MCCREA
CHRYSLER DEFENSE INC
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06956
ARTHUR H MCCRUM
LOCKHEED-GEORGIA COMPANY
86 SOUTH COBB DRIVE
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46240
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PROGRAM MGR, PRODUCT ASSURANCE
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46123
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46131
L BRUCE MCDONALD
MCDONALD & ASSOC INC
PRES /HUMAN FACTORS ENGR
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46447
LOWELL T MCDONALD
NORTHROP SERVICES INC
1315 S SEMORAN BLVD BLDG 5
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48307
BILL MCDOWELL
NTEC
CMR TEAM CHIEF, NSC CHARLESTON
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47421
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CANADIAN ARMED FORCES
101 COLONEL BY DRIVE
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43190
T R MCGEE
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N-462
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46145
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43194
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WEAPONS SYS TRN PROGRAM MGR
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3801 SOUTH OLIVER M/S K32-90
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43200
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PROJECT MGR
MANTECH INTERNATIONAL CORP
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38891
LT COL S P NORTHRUP
CDN ARMED FORCES NAT DEF HQ
101 COL BY DRIVE
OTTAWA ONTARIO CANADA
K1A 2K0 00000

43201
JOHN S NORTON
PROGRAM MGR TRNG SYSTEMS
HONEYWELL INC MN 17-2302
2600 RIDGEWAY PARKWAY
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45904
AL NUNES
SANDERS ASSOCIATES, INC
SR. SYSTEMS ENGINEER
95 CANAL ST MER12-1203
NASHUA NH 03061

48317
JAMES O'BRYANT
PM TRADE
DRCPM-TND-PC
ORLANDO FL 32813

45969
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SINGER CO
COLESVILLE RD
BINGHAMTON NY 13902

45981
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USAF
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AFHRL/AZ
BROOKS AFB TX 78235

47391
RICHARD W. O'DELL
US AIR FORCE - ASD
CHIEF, FLT SIMULATOR BRANCH
WPAFB OH 45385

48315
LTC CARL O'HALL
PM TRADE
DRCPM-TND-PC
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46133
L E OBORNE
LOCKHEED CALIF CO
VTX TRNG SYS MGR
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46623
R OGUS
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43203
H C OKRASKI
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46622
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48320
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45796
WALTER F POWERS
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37761
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45339
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47392
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4637 CANNA DRIVE
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42896
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46599
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45675
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42901
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43265
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V P TRAINER SYSTEMS
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AN GARTANGER 10
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ASTRA ONTARIO
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45900
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45463
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45940
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US ARMY AIR DEFENSE SCHOOL
DIRECTOR OF TRAINING DEVELOP
FT BLISS TX 79916

47439
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SANDERS ASSOCIATES, INC.
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37638
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43301
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REFLECTONE INC
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47406
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15897
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GOULD INC HYDROSYSTEMS DIV
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46646
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48299
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46603
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SIMUFLITE - 7
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45997
ROBERT STIRLAND
EVANS & SUTHERLAND
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580 ARAPEEN DR
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07085
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SANDERS ASSOCIATES INC
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ROBERT D. STODDARD
SANDERS ASSOCIATES, INC.
GOVNT. APPLIC. MRKT. MGR.
DANIEL WEBSTER HIGHWAY, SOUTH
NASHUA NH 03061

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ASD/YWP
WPAFB OH 45433

46104
GENE STOSBERG
EMERSON ELECTRIC CO
ST LOUIS MO 63136

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EL CAJON CA 92020

37708
B A STUGEMO
AIR MATERIAL DEPT
FMV-FE
STOCKHOLM, S-10450
SWEDEN 00000

48321
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PM TRADE
DRCPM-TND-PC
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48161
W SULLIVAN
NTEC
HEAD CONTRACT MGMT DIV.
N-65
ORLANDO FL 32813

46208
BRIAN SUMMERS
DEPT OF NAT'L DEFENCE CANADA
PROJ. OFFICER, NAT'L DEF. HQ
OTTAWA ONTARIO, CANADA K1A UK2
ATTN DAVSSE 5 00000

46266
BG ROBERT J SUNELL
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COMMANDER
US ARMY TRNG SUPPORT CTR
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ENGRG DIV
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R. SWINT
TARADCOM
C,INTEG.LOGIS.SUPPORT OFC.
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PERKIN-ELMER, SALES DIV.
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43343
CLAUDE THALMAN
PRESIDENT
POLYTRONIC AG LTD
CH-5630
MURI SWITZERLND 00000

46019
S THOMAREAS
GOULD INC SSD
PRES AND GEN MGR
50 MARCUS DR
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45954
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36957
MAJ WAYNE S WARREN
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ATIC-DST-DM
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48155
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BOOZ ALLEN & HAMILTON INC
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17204
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